THE

physical therapy

REVIEW

Volume 35 - Number 10 October 1955

The Chandler Table: Analysis of Its Rationale in the Mobilization of the Shoulder Joint – HELLEBRANDT, HOUTZ, PARTRIDGE and WALTERS

Development of an Objective Examination to License Physical Therapists for the Use of State Boards – GRIMM

Trends in Modern Massage Technics – TAPPAN

The Effect of Overload on Bilateral Transfer of a Motor Skill – WALTERS

Table Pulley Apparatus for Shoulder Exercise – VALLE

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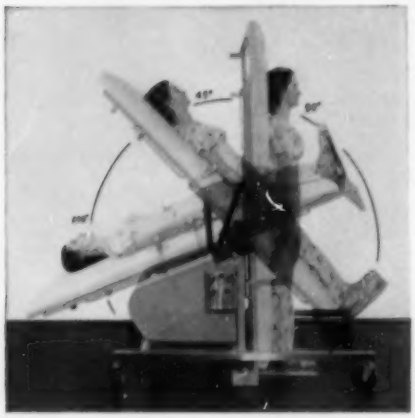

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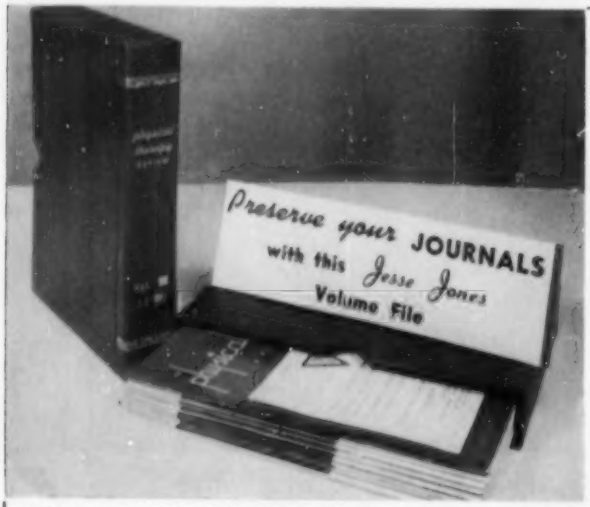

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The Physical Therapy Review

Official Publication of The American Physical Therapy Association

Vol. 35 October 1955 Number 10

The Chandler Table: Analysis of Its Rationale in the Mobilization of the Shoulder Joint

F. A. Hellebrandt, M.D., Sara Jane Houtz, M.S.,
Miriam J. Partridge, B.S., and C. Etta Walters, Ph.D.

The late Fremont A. Chandler, Professor of Orthopaedic Surgery and Chief of Orthopaedics at the Research and Educational Hospitals of the University of Illinois, was an astute observer with an intuitive appreciation of the biomechanical principles which explain the behavior of the human body in motion. At some time in the early 1930's he devised a special table to expedite the mobilization of the shoulder joint. The beliefs which had motivated the development of this piece of equipment were, *first*, that relaxation of the shoulder girdle musculature is better in recumbency than in the classical Codman position; *second*, that motion may be augmented by loading the moving part at its distal end; and *third*, that the momentum imparted by the load serves a useful purpose only if applied without grasping. The validity of these concepts had been proven abundantly by empirical practice.

Two weeks before Dr. Chandler's untimely death, an experiment was designed to demonstrate the physiological basis underlying the technic of shoulder joint mobilization which had been used for so many years on the Orthopaedic Service of the Research and Educational Hospitals. The purpose of this paper is to present the evidence collected and interpret its significance in terms of recent advances in the understanding of the mechanisms which control volitional movement.

From the Department of Physical Medicine and Rehabilitation, Research and Educational Hospitals of the University of Illinois, Chicago.

This study was supported in part by the Pope Foundation and United Cerebral Palsy of Chicago.

Material and Methods

Two series of experiments were performed, each on one normal adult subject. The first was planned to determine which muscle groups to sample electromyographically and how heavy a load to use to impart optimum momentum to the extremity being mobilized. Action potentials were picked up by skin electrodes and recorded after appropriate amplification by an 8-channel Offner ink-writing Crystograph. The initial observations were limited to the anterior, middle, and posterior deltoid, the long heads of the biceps and triceps, the wrist flexors and extensors. Loads of one, three, five and ten pounds were used. These were either grasped or suspended from a wrist cuff. The shoulder joint movements studied were anteroposterior swinging, transverse swinging, clockwise circumduction, and counterclockwise circumduction. These were performed either from the Codman position or the prone lying posture recommended by Chandler. In toto 97 repetitive movements were analyzed. These yielded 755 multiple-lead electromyograms.

The second series of experiments consisted of 156 individual procedures and 1,460 electromyographic movement patterns. The wrist flexors and extensors were omitted from the study and the clavicular portion of the pectoralis major,

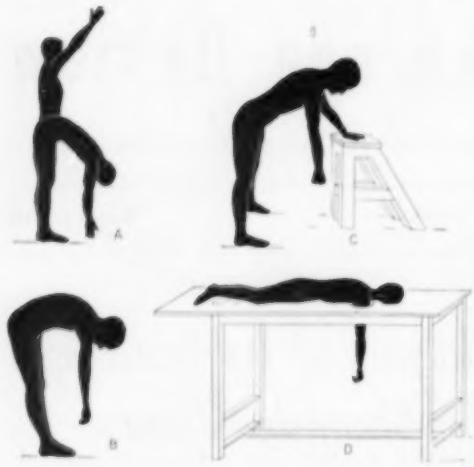

Figure 1. (A) Codman position as illustrated in his book. (B) Stylized reproduction of the posture assumed by our subjects during the performance of Codman exercises. (C) Sperry position. (D) Chandler position. The Chandler Table is 43 in. high, 86 in. long and 23 in. wide. The arm hole is 9 in. in diameter and is placed 25 in. from the head end of the table and 7 in. from each side.

teres major, and latissimus dorsi were added. All observations, other than the controls, were made carrying a five pound load, either actively or passively. The movements were executed in three ranges—small, medium, and maximum. An electrical signal was used to alert the electromyographer (who was stationed outside the shielded cage in which the experiments were performed) each time the subject reached the extremes of the forward thrust of the anteroposterior swing and the lateral thrust of the transverse swing. An arbitrary point on the periphery of the cone described by the pendant arm during circumduction was also noted. The signals were recorded manually on the moving electromyogram.

An intermediate semisupported position was introduced in addition to the two previously studied. This had been used by Sperry in the first electromyographic analysis of shoulder joint movements reported in the literature, and it is the posture commonly adopted by the physical therapist administering Codman exercises in the clinic. The stance is wide based and the weight-bearing limbs lean slightly forward. The trunk is flexed to approximately 45° and is supported in part by resting one arm on the edge of a table. The elbow joint of the supporting arm is extended. The opposite arm hangs free. This posture is easier to maintain than the classical Codman position in which the feet are placed together, the trunk is flexed strongly at the hips and both arms hang pendant.

To better reconstruct the postures assumed by the subject 140 serial photographs were taken, depicting body alignment at the extremes of the prescribed movements under various conditions of loading. These were individually reproduced with the aid of a Spencer microfilm reader, and the drawings thus made were matched with the electromyographic data to facilitate the analysis of the latter.

Results and Their Interpretation

Figure 1(A) is a reproduction of the sketch presented by Codman to illustrate the stooping position assumed during the arm swinging exercises advocated by him. When a jointed wooden artist's model is placed in this posture it cannot stand. The vertical projection of the center of weight of the model falls outside the supporting base as long as the legs remain perpendicular to the feet. If the angle of the ankle joint is increased by moving the buttocks of the model backward to counterbalance the forward flexion of the trunk, the figure remains upright in a posture simulating that assumed of necessity by the living subject when performing the Codman exercises (Figure 1(B)). To insure a stable posture from which the arm may be mobilized during stooping, the angle of the leg varies spontaneously with each change in the sagittal plane position of the upper extremity, and this autonomous realignment is exaggerated when a load is attached to the end of the freely swinging lever.

Neither of our subjects, both of whom were young and supple, flexed the trunk as sharply at the hip joints when performing Codman's exercises as indicated in figure 1(A). The angle of the pendant arm in the three starting positions used—Codman, Sperry, and Chandler— was approximately 100°, 65°, and 90° respectively (Figures 1(B), (C) and (D)). The positions assumed by the arm at the extremes of the anteroposterior swing are illustrated in figure 2, which depicts also the three conditions of loading.

The electromyographic evidence indicates that shoulder joint mobilization is accomplished with less neuromuscular activity in the prone lying position recommended by Chandler than in the

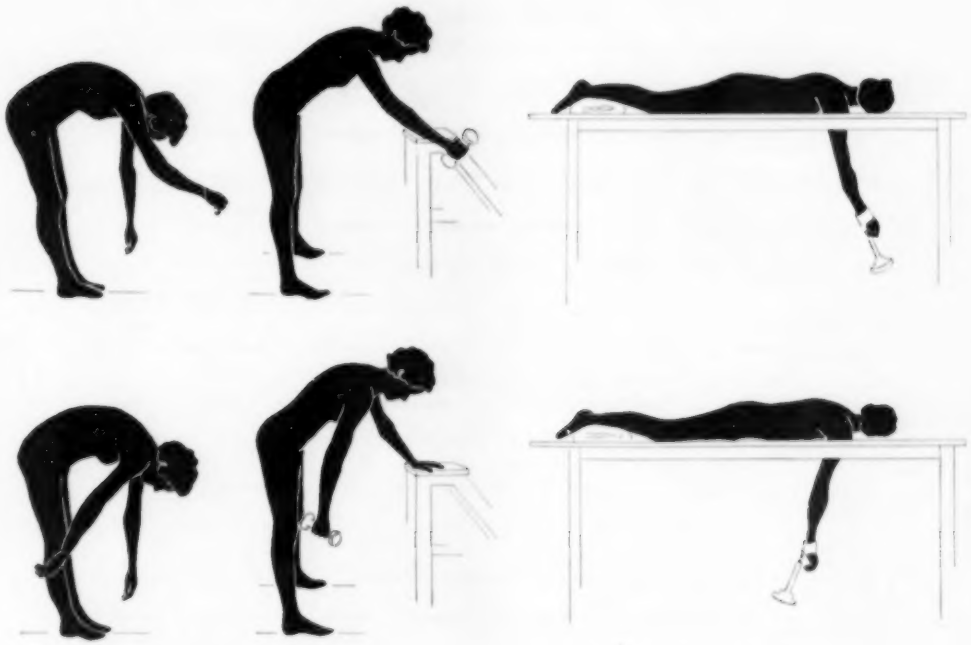

Figure 2. The range of anteroposterior swinging in the Codman, Sperry and Chandler positions, illustrating also the three conditions of loading. Reading from left to right these are: zero loading, grasping a five pound dumbell in the hand, and carrying an equivalent weight suspended from a wrist cuff.

stooped posture of Codman (Figure 3). Contrary to expectations, the Sperry position was consistently more demanding than Codman's. The electromyographic data show that supporting the weight of the trunk partially on one arm increases the action potentials which must be developed in the musculature of the contralateral half of the shoulder girdle to achieve maximal voluntary mobilization of the glenohumeral articulation. This was evident in both coronal and saggital plane swinging of the free extremity. Thus the expedient used commonly by the physical therapist to make the exercise easier to perform, i.e., leaning against a table for support during arm swinging, defeats its primary purpose in part by increasing reflexly the tonic activity of the musculature activating the joint to be mobilized. The evidence presented suggests that if the patient being treated does not possess the strength, stability or flexibility needed to permit free swinging of the upper extremity at the shoulder joint from an unsupported standing posture, the prone lying position should be used. This is the position of choice as recommended by Chandler, and the one in which mobilization appears to occur with the least inhibition from reflex tension in the shoulder girdle musculature.

Carrying a load at the end of the lever imparts momentum to the moving appendage and reduces significantly the action potentials evoked during mobilization once the part has been set into motion (Figure 4). The muscular activity necessary to initiate movement becomes progressively greater as the load is increased, but once the arm begins to swing, action potentials rapidly subside. At times no electrical activity could be detected. This was especially evident when intermediate loads were used. With light loads the driving force of gravity and momentum was insufficient to carry the arm through maximal range without the assistance of muscle action. Heavier loads appeared to increase traction at the glenohumeral articulation to a degree necessitating partial equilibration by the supporting musculature. Thus the second of the three Chandler

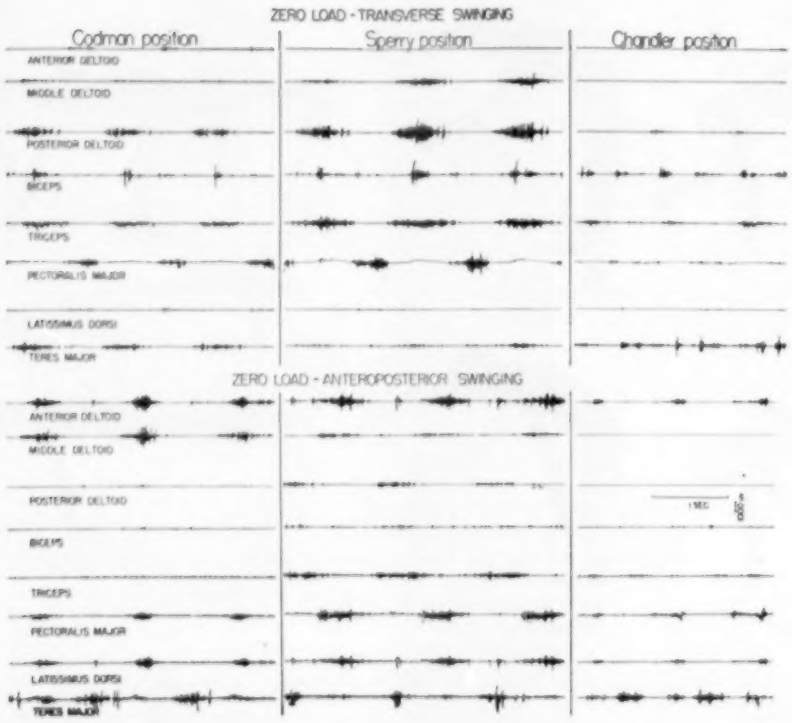

Figure 3 (Above). Comparison of the electrical activity evoked in selected muscles acting on the glenohumeral articulation during mobilization in the cardinal vertical orientation planes from the Codman, Sperry and Chandler positions.

Figure 4 (Above, right). Reduction in electrical activity by carrying a load which imparts momentum to the moving limb.

Figure 5 (Below, right). Diminution in electrical activity evoked during anteroposterior swinging by cradling the load in the curled fingers (lightly grasped). This is still further reduced when the mobilization is carried out in the prone lying position.

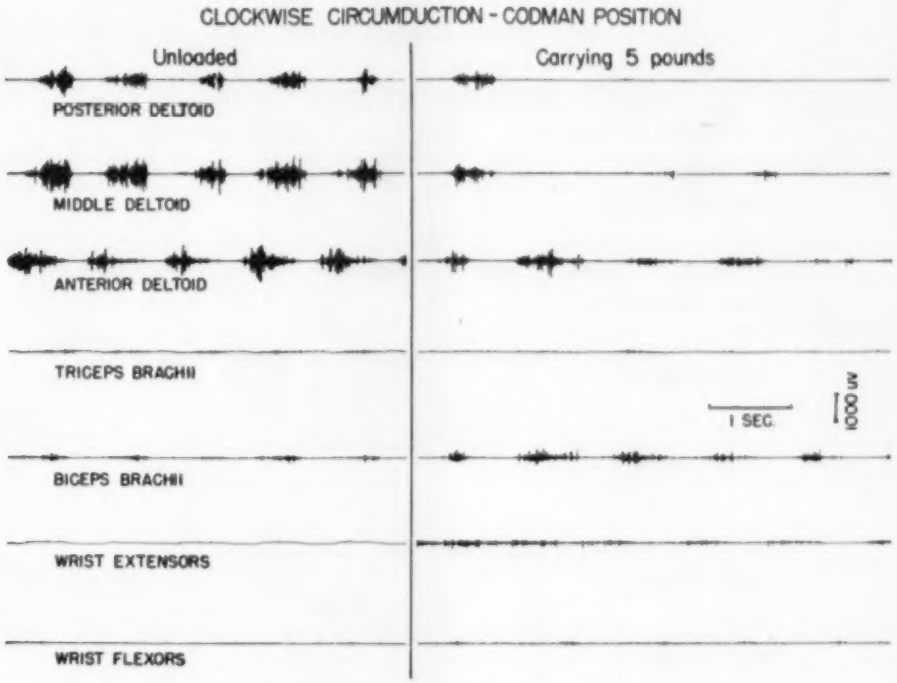

Figure 4.

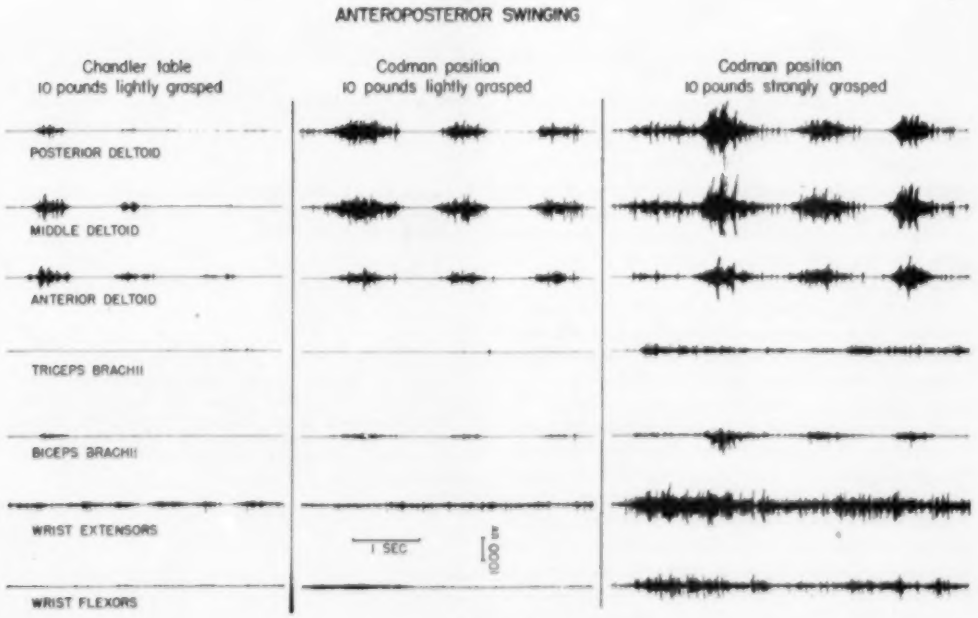

Figure 5.

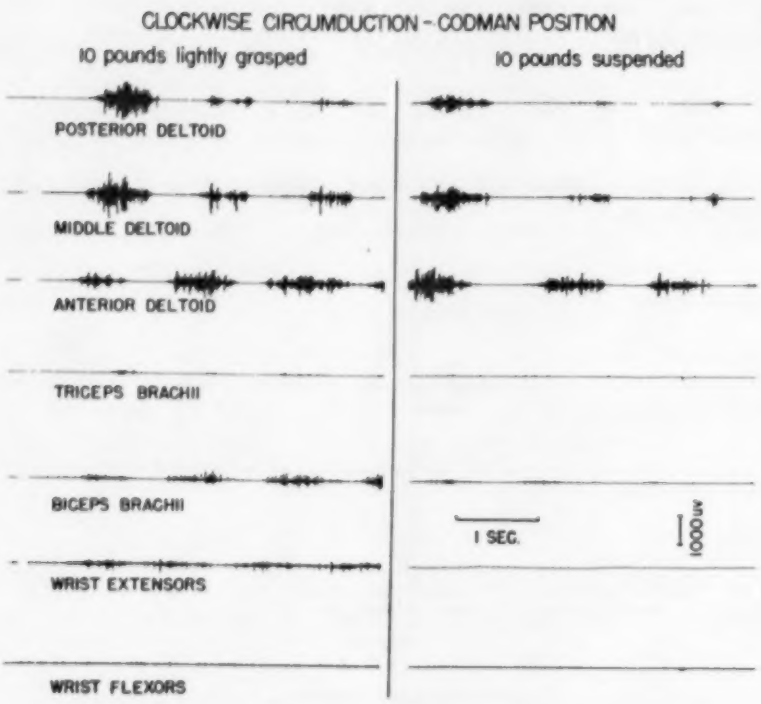

Figure 6. Diminution of electrical activity by suspending the load used to impart momentum to the limb.

recommendations finds support in the electromyographic evidence. If loading is judiciously applied, it expedites mobilization of the shoulder joint. Paradoxical though it may seem, it requires less neuromuscular activity to swing the arm through full range if the part is weighted than when it hangs free.

When a load is carried in the hand the natural tendency is to grasp the object strongly. We were able to demonstrate that the deliberate cradling of even a heavy load in the curled fingers not only lessens the neuromuscular activity of the wrist joint synergists, but also subdues the reflex contraction of the elbow and shoulder joint stabilizers (Figure 5). Furthermore, when the same load was lightly held while in a relaxed prone position on the Chandler table, to-and-fro pendular movements were virtually effortless. This was also true of side-to-side movements and circumduction. Avoidance of grasping by suspension of the load had a further salutary effect (Figure 6 and Figure 7). The paucity of action potentials

Figure 7 (Above, right). Diminution of electrical activity by suspending the load used to impart momentum to the limb.

Figure 8 (Below, right). Effortless shoulder joint mobilization from the Codman and Sperry postions. The backstroke in the latter carries the arm into a position of hyperextension. This accounts for the exceptional activity of the posterior deltoid and the triceps.

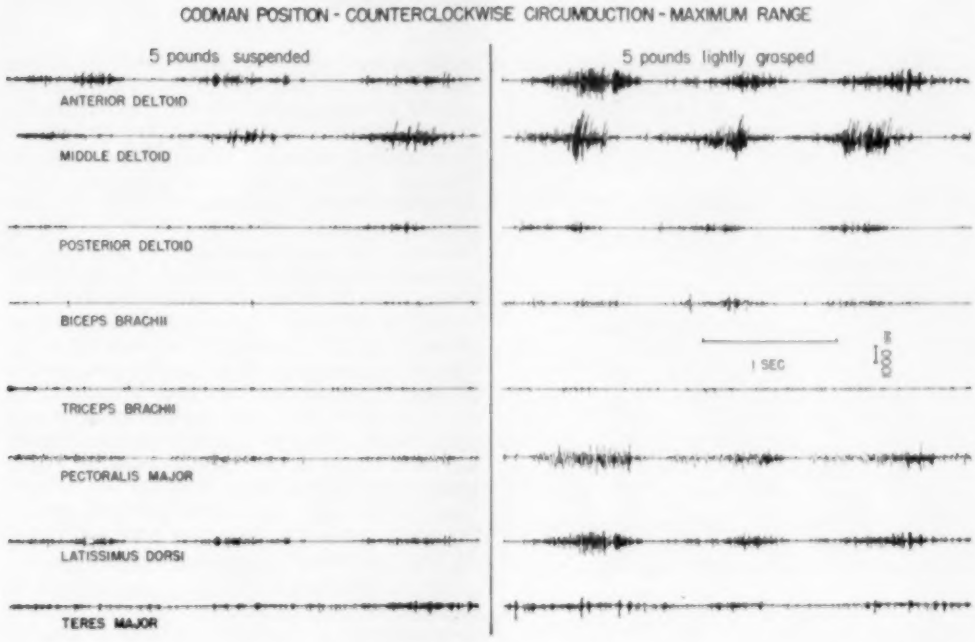

Figure 7.

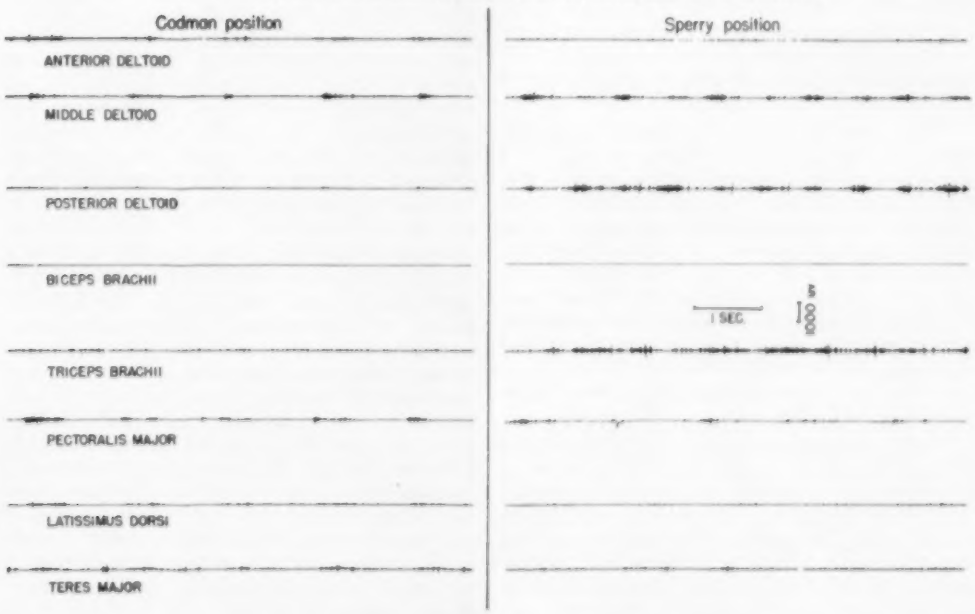

Figure 8.

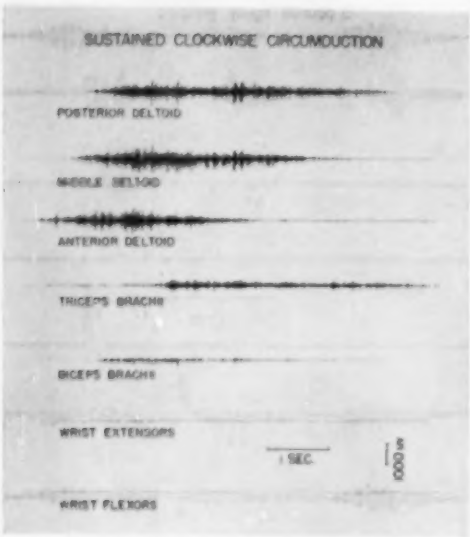

Figure 9. Sequence of muscle action during slow sustained circumduction in the Codman position carrying a load.

during small and medial range movements was remarkable, even during mobilization in the Codman and Sperry positions, if momentum was supplied by a suspended load (Figure 8). From an examination of the electromyograms alone it was often difficult to identify the source of the driving force for mobilization.

There was essentially no difference in the electrical activity evoked during skilled light grasping of a load and its suspension when the mobilization exercises were performed by a well trained experimental subject. An apprehensive patient, cautiously attempting to move a stiff and painful joint, would probably find it difficult to maintain a relaxed holding position of the hand grasping the load. Thus the simple expedient of suspending the weight required to impart momentum to the hanging limb, as recommended by Chandler, is a device which might be used to advantage in the clinic.

Many years ago Duchenne observed that the synergic action of the extensors of the wrist is necessary to the flexion of the fingers. Beevor concurred with this view in his Croonian Lectures on Muscular Movements. The activity of the wrist extensors during grasping is well demonstrated in the multiple-lead electromyograms we have presented. It may be seen that the biceps also regularly participates in the movement pattern and that there may be strong activity of the anterior deltoid. This is the pattern of response elicited by Gellhorn during stimulation of the biceps area of the cortex in experimental animals. The total extremity is involved. If the forearm is in pronation, action potentials develop concurrently in the shoulder girdle protractors, elbow flexors, and wrist extensors. The cocontraction is augmented in magnitude by adding resistance to the movement. The pattern may be elicited in man by the voluntary initiation of activity at either the wrist, elbow or shoulder joints. It is evident, therefore, why strong grasping of a load by peripherally disposed muscle groups increases the tonus of the proximal musculature and restricts shoulder joint mobilization. Thus, the clinical observer—Chandler—was aware of the intimate relation of the hand, wrist, elbow, and shoulder musculature long before their association in well defined integrated patterns of action had been established by the experimental neurophysiologist.

The sequence in which the various heads of the deltoid come into action is unusually well demonstrated in figure 9. This is a so-called "sustained Codman" maneuver, performed while carrying a moderately heavy load. The humerus is advanced and then slowly circumducted in a clockwise direction in ever increasing circles of motion. The electromyogram reproduced represents maximal mobilization. The anterior deltoid carries the limb forward. The activity of the anterior deltoid is accompanied by a feeble but invariable concurrent action of the biceps and wrist extensor. The middle deltoid comes into action when abduction commences. Finally the posterior deltoid fires as the limb swings backward, being assisted by the long head of the triceps.

When circumduction is executed at normal speeds and the arm is allowed to swing freely, the motion is vastly different from that described above. It become ballistic. As originally demonstrated by Sperry, maximal electrical activity then occurs at the peak of the reciprocal shoulder joint movement (Figure 10). Each muscle fires briefly. In clockwise circumduction the anterior deltoid fires first, then the middle deltoid and finally the posterior deltoid. The sequence is reversed in counterclockwise circumduction. The antagonists are never directly opposed. Their periods of activity overlap. Circumduction was too complicated a movement to permit accurate spotting of a fixed point in its course by the gross inspectional method used (i.e., the flashing of an electrical signal by an observer stationed inside

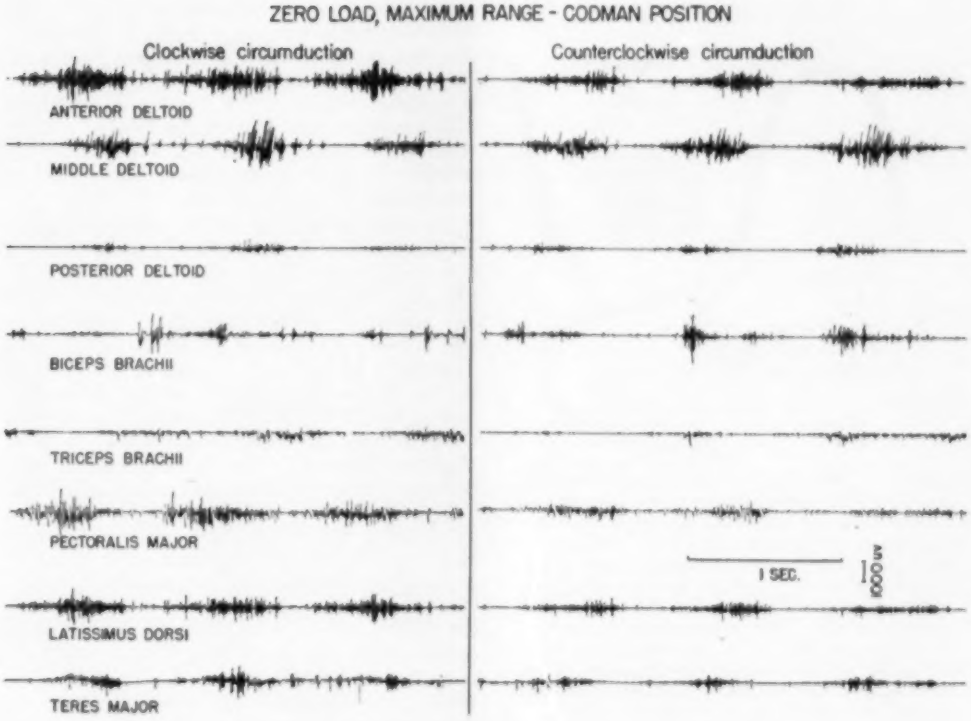

Figure 10. In this illustration the EMG paper is moving two times as fast as in figure 9. The circular movement is also being performed at a relatively high speed.

the EMG cage). Sperry found that each individual pulse reaches its maximum intensity in the reciprocal movement, indicating that the tension developed acts first to modulate the swing and then to provide the force required to reverse its course.

Ballistic movement is demonstrable also during relaxed coronal and sagittal plane pendular swinging of the arm when carried out in the natural rhythm voluntarily assumed by the normal subject (Figure 11 and Figure 12). The extreme forward thrust of the anteroposterior swing and the lateral thrust of the transverse swing could be spotted with sufficient accuracy to warrant analysis of the time course of the activity of the individual muscles sampled electromyographically.

Free swinging anteroposterior and transverse movements of the shoulder joint are clearly ballistic in nature but the situation is altered when a five-pound weight is strongly grasped during mobilization. For example, during anteroposterior swinging the anterior deltoid now fires continuously and the biceps contributes prominently to the EMG pattern. This is probably related to the act of grasping which is always associated with a strong contraction of the wrist extensors and cocontraction of the biceps and anterior deltoid. The action of the pectoralis major and the latissimus dorsi is more prolonged. The teres major is significantly less active, suggesting that the loaded arm may now fall backward under the influence of gravity. The teres does not pick up the drive until the motion is well under way. The triceps also fires strongly during the forward thrust to keep the loaded arm from flexing at the elbow joint. Thus the act of grasping has considerably modified the simple ballistic pattern demonstrated in free swinging.

When the load is suspended the arm again

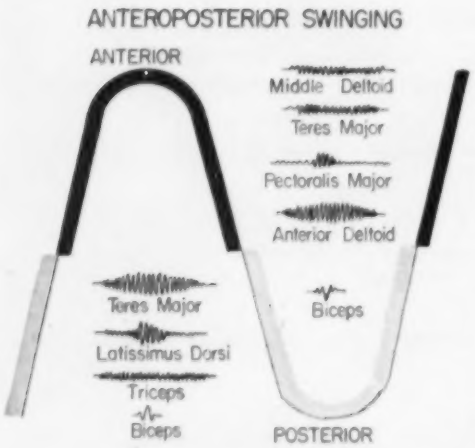

Figure 11. This diagram was reconstructed from the analysis of a large number of electromyograms. The beat-stroke is antagonized by a strong contraction of the teres major. This stops the forward thrust and drives the arm backward. This is aided by a concurrent activity of the latissimus dorsi and the long head of the triceps. The long head of the biceps fires feebly. The back-stroke is antagonized by a strong contraction of the anterior deltoid which reaches its maximal intensity at the point of reversal in the movement cycle. This drives the arm forward ballistically with the assistance of the pectoralis major, gravity and momentum. The middle deltoid keeps the arm abducted sufficiently to clear the body and the teres major modulates the forward movement.

starts forward under the impulse of a slight ballistic thrust by the anterior deltoid. It then swings effortlessly, momentum carrying it forward. Biceps action virtually disappears but the triceps continues to act to keep the elbow extended.

Discussion

The term "*contraction ballistique*" was introduced by Richer late in the 19th century. While engaged in the chronophotographic study of movement he became interested in observing the behavior of antagonistic muscles. Beaunis had concluded that two muscles antagonistic in function may contract simultaneously, that one may shorten while the other remains immobile, or that one may contract while the antagonist elongates. Richer noted that the biceps could be seen contracting vigorously in one picture and relaxed in the next, while the triceps entered into action. Observing the behavior of the quadriceps in knee extension in another study, he was able to demonstrate that it relaxed completely before the limb approached the extreme of motion. He considered these to be examples of a particular kind of contraction which drives the limb in one direction but ceases to act before the extremity reaches the end of its course, and named it "*ballistique.*"

Early in the present century the psychologist Stetson of Oberlin, began the systematic study of ballistic movements and their importance in the execution of skilled acts. This culminated in 1935 in extensive electromyographic observations which were conducted in collaboration with Bouman, a young Dutch physician, now Head of the Section on Physical Medicine and Rehabilitation at the University of Wisconsin. Stetson and Bouman were able to demonstrate that the most important feature of the ballistic type of contraction is action without opposition in the beat-stroke, so that the appendage being mobilized swings free. It is carried by momentum and may be brought to rest either by the passive stretch of muscles and ligaments or by antagonists, which then contract unopposed in their turn so that the limb is thrown once again during the back-stroke of the movement cycle. Thus each half-beat of the repetitive pattern is composed of an impulse, momentum, and arresting phase. If the movement is speeded up the contraction occurs more and more in advance of the actual displacement of the appendage being mobilized. They observed that when the movement is rapid, the contraction occurs during the last one-third or last one-half of the preceding reverse movement so that the muscle group responsible for the forward thrust of an anteroposterior swing, for example, would develop tension early enough to stop the back-stroke, and at its end provide the pulse for the beat-stroke. This was confirmed specifically by Sperry, who also worked in Stetson's laboratory.

Peters and Wenborne studied the time pattern of rapid voluntary movements of the arm and hand and observed that velocity increases over the first half of the movement cycle and then falls off. Thus each pulse in a repetitive movement cycle has two points of minimum velocity, one at the start and the other at the finish of the stroke, and one maximum in the middle of its course. This was subsequently confirmed by Fenn. Using an electromyogram from some earlier work of Wacholder he showed that in fast movements the agonists relax in the middle of the swing and the antagonists go into contraction in order to

bring the moving limb to a stop, with little or no overlap of the periods of activity of the two sets of antagonistic muscles. Both contract isometrically and with maximum tension at the point of reversal in the swing. In slower movements there is less need for active contraction of the antagonists. The force of gravity may then be sufficient to bring the moving part to rest. At this frequency the limb oscillates in its natural period with only a short burst of activity in the flexor muscles at the beginning of flexion and in the extensor muscles at the beginning of extension. Abundant evidence therefore appears to exist which suggests that the voluntary muscles of man can exert their force in three different ways: without changing in length, while shortening, or while lengthening. All quick forceful movements are accompanied by a lengthening contraction of antagonists which modulate the response and give it the qualities so aptly described by Duchenne. ". . . all the movements of the limbs and trunk result from a double nervous excitation by virtue of which the two orders of muscles, the impelling and the moderating associations are put simultaneously into action, one to produce the movements, the other to moderate them. Without this entente of the antagonists the movements lose inevitably their precision and certainty."

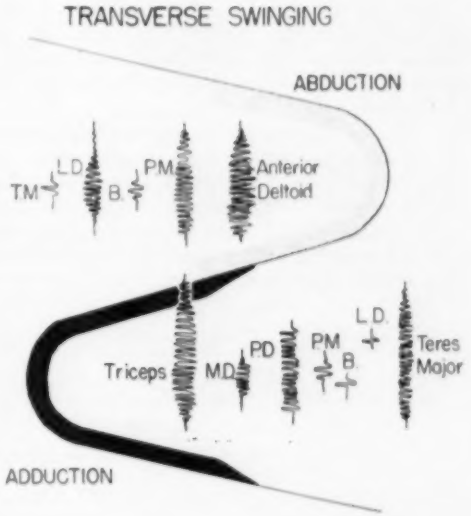

Figure 12. Transverse swinging is purely horizontal abduction and adduction in the prone lying position. The beat-stroke, abduction, is ballistic in this illustration and associated with maximal activity in the horizontal adductors. The arm drops to the midline in the back-stroke largely under the influence of gravity and momentum. The triceps fires strongly early in adduction to keep the elbow extended.

SUMMARY AND CONCLUSIONS

Two series of experiments yielding more than 2,000 multiple-lead electromyograms were performed on two normal adult subjects to establish the rationale of shoulder joint mobilization from a prone lying position using a weight suspended from the wrist to impart momentum to the limb. Action potentials were picked up with surface electrodes from the anterior, middle, and posterior deltoid, long heads of the biceps and triceps, clavicular portion of the pectoralis major, latissimus dorsi, teres major, wrist flexors and wrist extensors. Coronal and sagittal plane swinging and circumduction were studied in ranges progressing from small to maximal. The influence of variable loading of the limb by suspension of a weight from a wrist cuff was compared with light and heavy grasping. Mobilization in the prone lying position was contrasted with that performed in the classical stooped posture advocated by Codman and in an intermediate stance which permitted the subject, who leaned forward from the ankle joints with the trunk flexed moderately at the hips, to place one hand on a table top for stabilization. The alignment of the body during the extremes of mobilization was recorded photographically. The evidence presented supports the following conclusions:

1. Shoulder joint mobilization is accomplished with less neuromuscular activity in the prone lying position of Chandler than in the stooped posture recommended by Codman.

2. Leaning against a table with one arm for support during free swinging of the opposite extremity increases the tonic activity of the shoulder girdle musculature of both sides and augments the tension required to effect maximal mobilization of the glenohumeral articulation.

3. Carrying a load imparts momentum to the moving appendage and reduces the electrical activity evoked during mobilization once the part has been set into motion.

4. Grasping the load increases the tension of the shoulder girdle musculature reflexly and by virtue of this presumably restricts mobilization.

5. Suspending the weight used to impart momentum to the limb reduces the neuromuscular activity required to attain maximal mobilization.

6. In the hands of a well trained normal subject cradling the load lightly in the curled fingers during shoulder joint mobilization reduces electrical activity but is less effective than suspension of the load from a wrist cuff.

7. Proof is presented in support of the rationale of the major points motivating the development by Chandler of a special table to expedite mobilization of the shoulder joint.

8. Multiple-lead electromyography suggests that the so-called swinging exercises of Codman are ballistic movements.

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Development of an Objective Examination to License Physical Therapists:

For the Use of State Boards

Elaine R. Grimm, Ph.D.

By the end of 1952 fifteen states and the Territory of Hawaii had enacted legislation for the licensing of physical therapists; since that time nine more have followed suit. The majority of the state laws setting up the machinery for such licensing required candidates to pass a written examination in addition to meeting specified education and training requirements. In most instances the written examination consisted of a number of essay questions which had been constructed and were graded by the state board members. Mindful of the advances in test construction which had been made during the past two decades, some state board members and others concerned with licensure were dissatisfied with this approach. The use of objective examinations would not only relieve the examiners of the burdensome and uncertain task of grading essay questions but would provide a more accurate way of assessing a candidate's knowledge without the intrusion of irrelevant factors. Objective examinations would permit a wider and fairer coverage of subject matter, objectivity in scoring, and the employment of statistical procedures for comparing individuals and groups as well as for improving the test itself. While such examinations could be constructed under the guidance of test specialists with adequate facilities, no state board could afford to undertake such a major project for the relatively small number of candidates it examined each year.

The American Physical Therapy Association because of its interest in maintaining high standards in the field of physical therapy was concerned about the adequacy of tests which, in effect, allowed a successful candidate to be recognized by the public and by employing agencies as a qualified professional, capable of administering physical therapy. The Professional Examination Service of the American Public Health Association had for some time been engaged in the evaluation of professional competence and felt that its services could be made available to licensing boards in physical therapy.

Assistant Director, Professional Examination Service, American Public Health Association

The American Physical Therapy Association, therefore, contracted with the Professional Examination Service to construct an objective examination which would be released to state boards. The Association thus underwrote the initial expense of constructing the examination, which made it possible for states to pay only a relatively small per capita fee when using the examination. In addition, the Association appointed an Advisory Committee on Examinations to participate actively as a consulting group in the preparation of the test. The members of this continuing committee are Elizabeth Addoms, Lucille Daniels, Dorothy Hewitt, Mary Elizabeth Kolb, and Florence Linduff. The Professional Examination Service assumed responsibility for all the technical work in test development as well as the provision of professional consultation.

DESCRIPTION OF THE TEST CONSTRUCTION PROCEDURE

During the fourteen years it has been in existence the Professional Examination Service has had extensive experience in developing objective examinations for evaluating professional personnel.* For some time selection examinations in physical therapy had been prepared by the Service. While the initial function of this organization was to construct examinations which could be used by state and local health departments for selection purposes, in recent years the Service has expanded its functions to cover certification and licensing programs—those carried on by professional certifying bodies as well as by state licensing boards. Through these experiences, the Service has developed a set of technics and procedures for test construction and for working with boards of examiners.** Inherent in these procedures is the principle of close cooperation between subject matter and test specialists in all phases of the development and use of examinations. These same methods were used in preparing the physical therapy licensing test, with the Advisory Committee, as well as the Physical Therapy Consultant of the Professional Examination Service, Barbara White, serving as the subject matter specialists.

The first meeting of the Advisory Committee on Examinations and representatives of the Professional Examination Service was held in February, 1953. It was decided that a file of examination questions, rather than just the number of questions needed for a single examination, would be developed in order to have adequate material on hand for revisions and a reserve for future examinations. The first task of the Committee was to set up an outline of the subject matter to be covered in the examination. In developing this outline they considered the requirements of all the state licensing laws in order to make certain that any state desiring to take advantage of the Service would find adequate coverage of all the areas specified by its law. The Committee members exercised their judgment as to the number of questions which were to be inclued in each subject. It was decided that a total of 310 questions be used, divided into three sections for convenience in administering the examination. The final examination consists of three parts—110 items in Basic Sciences, 55 in Clinical Sciences, and 135 in Physical Therapy Theory and Procedures.

The next task consisted of having the examination questions written. Only multiple-choice questions, which contain a statement of the problem with one correct choice and four wrong ones, were used. This type of objective question has been found to offer the greatest possibility for adaption to a variety of subject matter, as well as lack of ambiguity and objectivity in scoring. An example of a typical question is:

> While giving a patient a manual muscle test, you find that the flexor muscles of the shoulder are graded "good" but that the patient is unable to flex his shoulder against resistance. The muscle in which you would then look for weakness is the:
>
> 1. pectoralis minor.
> *2. serratus anterior.
> 3. infraspinatus.
> 4. latissimus dorsi.
> 5. teres major.

Following the usual policy of the Professional Examination Service, the questions were written by people actively engaged in the practice of physical therapy; under this system the questions represent a number of different viewpoints. Item writers are instructed to draw upon their own experience and to construct questions which require the exercise of judgment rather than merely a memory for textbook details. The American Physical Therapy Association already had on hand over 1,000 questions which had been submitted by a large number of physical therapists. The questions, however, had not up to this time been edited or processed in any way. The Committee members and the test specialists edited these items and selected from them those they considered useable for the licensing examination. A list of subjects in which additional questions were

*See Reference 1
**See References 2 and 3.

needed was then drawn up and the Committee suggested the names of physical therapists to be requested to write questions. Aside from the item writers who participated in the project through the school section, approximately 120 physical therapists throughout the country up to the present time have constructed questions for this file.

When the questions were received they were edited by a test specialist and by the Physical Therapy Consultant of the Professional Examination Service. They were then sent out in groups of fifty to panels consisting of three physical therapists who had previously been selected by the Committee to serve as reviewers. Approximately 60 physical therapists have served in this capacity. The reviewers were asked to answer each question as if they were taking it on an examination, then compare their answers with the answer given, and to make criticism of the items. When all the comments had been received the items were again reviewed by a test specialist and by the Physical Therapy Consultant. The final decision on the questions rested with the members of the Committee.

The Committee met again in August, 1953 to make the final decision of approval or disapproval of each of the items and to make the final selection of the 310 questions for the examination. The examination was then prepared and state boards were notified of its availability as of October, 1953.

METHOD OF REPORTING RESULTS, STATISTICAL ANALYSIS AND REVISION

When a state board indicates an interest in the examination and requests a copy of it, a master copy is sent to the executive of the state board for inspection by the board members. If a state board desires to order the examination, the Professional Examination Service supplies a manual of instructions for administration of the examination, the required number of copies of the examination, and answer sheets and pencils.

After administration all the material is returned to the Professional Examination Service where the answer sheets are scored. Results are reported to the state board usually within a week or ten days of the time the papers are received. In addition to the scores for each candidate and such statistical information as the average score and variability of the group which was examined in this state, the boards are also presented with cumulative data from previous administrations of the examination in their own state as well as from other states using the examination. It is especially valuable to the board to have comparative data if only a few candidates have been examined in their particular state. For example, the board can easily determine how far above or below the average their candidates are, in comparison with other candidates who have taken the examination. The Professional Examination Service does not set the passing point but, if requested, will make suggestions. The determination of the passing point is a prerogative of the licensing board and the place at which this point is set will depend upon the standards the board chooses to maintain. (The procedure for determining the passing point which is recommended by the Professional Examination Service will be described in detail in a companion article.) While the same procedure is followed in scoring all papers, state laws vary somewhat. In some states it is stipulated that candidates must receive a passing score in all of the subject matter areas, while in others a passing grade on the total examination is all that is required. Unless such special conditions have been stated, the general procedure is to send the candidates' scores on the three parts and on the total examination.

It is the policy of the Professional Examination Service to perform a statistical analysis of each question in an examination (item analysis) as soon as it has been given to enough candidates to warrant such statistical treatment. An example of the analysis of one item is presented in figure 1. These statistics refer to the sample question on page 557, and do not represent actual data. From such an analysis one can obtain information about the difficulty level (percentage of candidates who answered the question correctly), the distribution of choices of the candidates, and the discriminating power of the question. The degree of discrimination of the question indicates the extent to which "well qualified" candidates answer the question correctly, and "poorly qualified" candidates miss it. Since, for all practical purposes in this situation, there is no possible criterion of competence other than the examination which can be used as a common measuring rod to determine the competence of the candidates, the best estimate of a candidate's ability is assumed to be his score on the total examination. The ideal item would thus be answered correctly by all those scoring high on the examination (upper group) and failed by all those with lower scores (lower group). In practice, this ideal is never reached, but the more closely the item approximates it, the more discriminating the question is.

Figure 1

An example of the analysis of the item on page 557.

DISTRIBUTION OF RESPONSES N = 100 U = 25 M = 50 L = 25

No. of item	%P	C.R.	Sig.	Omit U	Omit M	Omit L	1 U	1 M	1 L	2 U	2 M	2 L	3 U	3 M	3 L	4 U	4 M	4 L	5 U	5 M	5 L
115	54	3.87	.01			1		1	2	*18	30	6		2	2	4	9	9	3	8	5

The item analysis in figure 1 shows that the question was item number 115 in the examination. Fifty-four per cent of the candidates answered it correctly, which means that the question is of average difficulty. The numbers across the top refer to the numbers of the choices. The letters U, M, and L refer to the upper quarter, middle range, and lower quarter of the candidates grouped on the basis of their scores on the examination. One can see at a glance how many candidates in each group selected each choice. Choices 4 and 5 were better distractors than Choices 1 and 3. Number 2 is the answer. The chart shows that 18 of the 25 people in the upper quarter, and only 6 of the 25 people in the lower quarter selected the correct answer. The significance of this difference is expressed by a Critical Ratio of 3.87. This item is significantly discriminating at the .01 level, which means that there is only 1 chance in 100 that the difference between the number of "well qualified" and "poorly qualified" candidates who selected the answer is attributable to chance factors. The item is, therefore, to be regarded as highly discriminating.

The next task after the item analysis is made is to revise the examination on the basis of statistical information. If a question is found to be too easy, too difficult, not discriminating, or if the distribution of choices is poor, the item is changed in some way. In some instances the leading statement and/or one or more of the choices is revised; in others the entire question is reworded or replaced by another one.

In the fall of 1954 after the examination had been in use about one year and 148 candidates had been administered the examination, it was possible to perform a statistical analysis. In January of this year the Advisory Committee again met with representatives of the Professional Examination Service to revise the examination. This new form has been available to state boards since May.

USE OF THE EXAMINATION

Up to the present time seven states have used the licensing examination and, as of the date of writing, the test has been given to a total of 184 physical therapists.

The examination will be kept up to date and changes made whenever indicated by statistical results or by advice of the consultants. As new technics in physical therapy are developed and old ones discarded the examination will reflect these changes.

It is hoped that many more state boards licensing physical therapists will want to take the opportunity of using the examination as the written part of their assessment of physical therapists' qualifications for practice. The willingness with which so many physical therapists throughout the country have participated in this project is an indication of their concern for maintaining high standards in their profession and their desire to ensure that the abilities of physical therapists are being evaluated by the most accurate means available.

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Trends in Modern Massage Technics

Frances M. Tappan, M.A.

There was a time when physical therapy was thought of primarily as heat and massage, combined to some extent with exercise. World War II served to bring more emphasis upon activity and the exercise program with the newer concept of rehabilitation until at the present time many physical therapists and doctors have forgotten the usefulness of massage.

It is somewhat time consuming and often the results may seem more psychological than physiological. Even so, contemplation of the psychology of the handicapped indicates a regressiveness in human behavior when we are ill, with desires for understanding and sympathy; personal attention without maudlin overprotection. Massage sensibly administered will not only encourage the confidence of the patient, but will physiologically and reflexly relieve his pain and metabolically prepare the injured or involved muscles to exercise to a greater peak of capacity. Why then are most departments of physical therapy ignoring the usefulness of this procedure?

Therapists should think back over the exercise program which the department they work in has carried on for the past year. How many times has a good exercise program failed because of the patient's inability to fully cooperate due to pain, or inability to relax? Could that patient have been helped with only five minutes of massage?

Technics have not changed dramatically throughout the past 50 years. A recent survey, designed to analyze the most important and controversial aspects of the technics of massage would indicate the following trends in massage as it is being taught in most of the physical therapy schools today. It was discovered that the technics of Hoffa, McMillan and Mennell were the most commonly used. In 1900 Albert J. Hoffa published his book, *Technic der Massage* in Germany. This book is still the most basic of all texts on massage and the majority of physical therapists claim they use all or part of Hoffa's technics.

The fact that Hoffa was one of the earliest to describe massage in a text, coupled with the accuracy of his descriptions, may account for the fact that his five fundamental strokes are still being done today much as they were then, although the pattern, or area over which the stroke is carried may vary greatly.

McMillan's influence has been subtly added through her association with the army training schools of physical therapy, particularly in relation to such technics as positioning of the patient, maintaining contact on the return stroke, stroking off the whole area and alternate hand stroking.

Mennell's theory of "uncorking the bottle" by massaging the proximal aspect of a limb before the distal, is now being practiced by most physical therapists. As a rule they are following his principle of adapting the treatment to the patient's individual needs, rather than a routine which prescribes a specific number of strokes or for any particular length of time.

A motion picture, which illustrates primarily the technics of these three authorities was shown at the 1954 American Physical Therapy Conference. The audience was then asked to answer the following questions tabulated below.

CHART I

Purpose: To evaluate the usability and effectiveness of the motion picture "Modern Massage Technics."

Question:	Yes	No	No Ans.
Do you feel that this film will help to standardize the teaching of massage technics?	162	41	0
Would further films of this type be necessary in more detail (such as arm, leg)?	129	34	40
Does this present film adequately demonstrate basic technics?	139	43	11
Do you disagree strongly on any of the technics demonstrated?	35	86	82
Would you consider this film a valuable addition to your film library?	95	34	74
Do you plan to request it on loan?	53	57	93
Would you actually use the technics demonstrated here?	124	57	0

In the technics presented, no attempt was made to show the individual technics described by the

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three authorities, but rather the basic technics which are most commonly practiced today. It was interesting to note that the technics presented were acceptable to the majority of people who filled in the questionnaire, even though they express strong disagreement with *some* of the technics.

The conclusions of a master's thesis done in 1948 at Stanford University indicated that the majority of technics taught in physical therapy schools at that time could be traced to these three textbooks. Few schools taught a pure method of Hoffa, McMillan or Mennell. Most of them taught a combination of all three technics.

Results of the more recent study (Chart I) would indicate that during the past five years there has been very little change in the teaching of massage technics.

Historically speaking, massage technics have been performed in much the same way long before any of these three texts were written. There are only so many technics which can be executed to constitute a massage routine, namely, stroking, kneading, striking, compression and vibration, referred in many texts and by many instructors as effleurage, petrissage, tapotement, friction and vibration. Various authorities may emphasize the use of one technic more than another (Storm's technic for fibrositic nodules), which they prefer to use in some particular fashion for some specific purpose.

Mennell, for instance, describes a "superficial stroking" with emphasis on time. The return stroke through the air equals the stroke on the body, breaking contact to do so. Wier Mitchel, on the other hand, described a very similar type of rhythmical stroking for relaxation, applied to the spine which is light, rhythmical and alternate stroking in nature. Both technics are basically an application of light effleurage for reflex effects aimed primarily at obtaining relaxation.

It would seem logical then, to teach the fundamental strokes, using any or all of these three most prominent methods, to the new student, developing his or her judgment as to just when each of them should be applied as the condition warranted. As the young physical therapist matures he will then apply each stroke in the situation as needed. This is not as simple an approach as giving them prescribed routines such as "three strokes of effleurage to the biceps, etc . . ." but by presenting problems for them to solve in class, students can be encouraged to plan their own course of treatment, thus following Mennell's suggestion to adapt each treatment to the patient's needs.

Since most schools are teaching combinations of the basic technics, combination descriptions have been formulated which represent the strokes as the majority of schools are now teaching them. These strokes were demonstrated in the recent motion picture on modern massage technics. The written descriptions, based on five years of observation, conversation, demonstration, and discussion, with teachers in most schools, are presented here.

These descriptions do not represent the stroke merely as the author felt it should be done, but were developed to represent what the majority of schools are teaching in the case of each stroke. These composite technics have been written and rewritten many times and handed to people who knew absolutely nothing of massage. This process of rewriting went on until anyone who read them could follow the instructions and thereby perform the technic with reasonable accuracy and without asking for further definition or demonstration.

Interestingly enough, when these instructions were handed to untrained and absolutely "green" people, they performed the technic as described. Almost without exception, however, when given to a well trained physical therapist, already skilled in the art of massage, he proceeded to execute the technic as he had originally been taught, and not as it was described. Therefore, instructors using these instructions are warned that it will only confuse the class to give these instructions if the demonstration does not accurately follow the written directions.

Laboratories in Modern Massage Technics

LABORATORY I

Description of effleurage

Any stroke which glides over the skin without attempting to move the deep muscle masses is called effleurage. Newer terminology refers to this as "stroking," which is indeed a very descriptive term. The hand is molded to the part, stroking with firm and even pressure, usually upward.

Purpose of effleurage

This stroke is usually used for the beginning and ending of every massage as well as in between all other strokes. It accustoms the patient to the touch of the physical therapist and allows sensitive fingers to search for areas of spasm and soreness. In given instances where extreme sore-

ness is present it may be the only stroke employed. It serves to evenly distribute whatever lubricant is being used.

Position for effleurage to the back

First see that your patient is comfortable, lying prone with the feet either off the end of the treatment table or supported at the ankle by a roll or pillow. A pillow under the abdomen is often a good idea and the arms may be placed wherever they are most comfortable. The head may be turned to either side.

Draping for massage to the back

The patient can be asked to loosen or remove any clothing which might interfere with the physical therapist's massage. This can be done after he has been covered with a sheet. If he needs assistance it should be given when he asks for it or if the physical therapist notices that he seems to need assistance. It is usually easier for the patient to loosen all clothing before turning to lie prone. The physical therapist then pulls the sheet down to the level of the coccyx, being careful not to expose the gluteal cleft. This sheet can be tucked over the edge of the patient's clothing or pajamas in order to protect them from the lubricant.

Application of effleurage to the back

Since powder leaves a clear pattern to follow, apply it generously. Place both hands on the patient's back at the level of the coccyx, with the heel of the hand close to the spine and the fingers pointing outward. Make sure that the whole hand is relaxed so that all parts of the palmar surface of the hand touch the patient's body. Allow the hands to glide slowly along the erector spinae group, being careful to avoid pressure over the spinous processes. As the neck is approached the hands move upward to the base of the skull with the fingers molding over and in front of the shoulder to encompass the whole upper trapezius.

The return stroke downward may have lighter pressure progressing laterally, following the fibers of the upper trapezius to the shoulders and thence down the latissimus dorsi to the upper half of the gluteals.

Effleurage may be light or deep depending on the amount of pressure applied, but this pressure should be the same throughout the stroke, until the student learns more about how to vary it. Points to check while practicing:

1. Is the patient *comfortable?*
2. Is the patient *relaxed?*
3. Are the *hands* of the *physical therapist* relaxed?
4. Is pressure even throughout each stroke?
5. Is the stance one of good body alignment, with weight over feet, or has the weight been allowed to fall forward over the treatment table?
6. Is *all* of the hand in contact with the patient?
7. Look at the powder patterns on the patient's back.

LABORATORY II

Variations of effleurage

Whenever the pressure on any effleurage stroke over any part of the body is light, it is referred to as *light effleurage* (or stroking) regardless of which part of the body it is applied to or what pattern may be followed.

By the same token, any effleurage wherein the pressure is deep is referred to as *deep effleurage.* Stroking and effleurage are terms that may be used synonomously.

The student should now attempt to make his pressure light, throughout the entire stroke and again deep for the whole stroke. If he can do this well he may then try to let his pressure start light and increase until it is quite deep, tapering off again until it is quite light at the end of the stroke. The student should then ask the patient to guide him by telling him which pressure feels best, remembering that this "patient" is not one with an injured or arthritic back, but an essentially healthy one.

"Knuckling"

Knuckling is a stroke particularly associated with the technics of Hoffa. In discovering it he says, "If the part to be treated is covered by thick fascia, effleurage is not deep enough. You need greater pressure, therefore the convex dorsal sides of the first interphalangeal joints must be used. Clench the fist in a strong plantar flexion, the peripheral end of the knuckles should be upwards. Gradually bring the hand from plantar to dorsal flexion. Pressure is not continuous, but swells up and down, starting lightly and becoming stronger, then decreasing again in pressure. The hand must not adhere to the part but should glide over it lightly. Knuckling should only be used where there is enough room for the hand to be applied." (Albert J. Hoffa, *Technic der Massage,* Stuttgart, Germany, F. Enke, 1900, p. 2.)

Shingles

This name refers to an alternate type of stroking in which one hand follows the other with the strokes overlaying themselves one after the other like the shingles on the roof. Thus, although contact with the patient is lost as each hand is lifted, the remaining hand maintains contact to give the patient a feeling of constant contact of the therapist giving massage.

"Bilateral tree" stroking refers to both hands progressing simultaneously on either side of the back, from the spine laterally and upward with short strokes that build upward like the branches growing from the trunk of a tree.

Three count stroking of the trapezius can be done with a rhythmical three count stroke which begins at the origin of the lower trapezius, progressing with one hand toward the insertion. Simultaneously the other hand moves to the origin of the middle trapezius where it begins its stroke just as the other hand concludes, progressing toward the insertion of the middle trapezius. As soon as the first hand has completed its stroke of the lower trapezius it progresses *without contact* to the origin of the upper trapezius and strokes downward to the insertion to complete the third part of this three count routine. This particular method of stroking the whole trapezius is rhythmical and relaxing when well done, but must be timed like the "shingles" strokes so that in spite of the lost contact as each hand is raised, the patient feels constant contact because one hand is always stroking. It is a matter of coordination.

Fulling

This stroke is particularly useful when applied to the low back. Place both hands lightly on the patient's back. Using a stroke similar to effleurage, move the right hand forward and the left one backward with firm pressure. When the hands have gone as far to the sides of the patient as possible, the stroke is reversed and as the hands reverse direction a strong *lift* and *pushing together* of the hips is executed. The returning hands continue all the way over to the opposite side of the patient, thus going from side to side across the back. No pressure should be placed over the spinous processes as the hands pass over them. Greatest pressure comes into the *lift* and *push together* of the low back as the hands pull upward and inward to meet and cross over the spinous processes and continue on down each side of the patient. This feels especially good to the patient who has a sacroiliac involvement.

"Superficial Stroking"

Primary points which distinguish superficial effleurage from light effleurage are its unidirectional flow "going either centripetally or centrifugally but never in both directions"; its return stroke through the air which must be "controlled as for rhythm" taking as long as that part of the stroke which contacts the patient. Only the lightest possible pressure is used in this stroke. (Mennell, *Physical Treatment*, pp. 24-27.)

LABORATORY III

Description of petrissage

Petrissage consists of kneading manipulations which press and roll the muscles under the hands. It can be done with one hand, where the area to be kneaded is small enough, or it can be done with two hands on larger areas. It can even be done with two fingers on very small areas. There is no gliding over the skin except between progressions from one area to another.

Purpose of petrissage

This kneading motion of petrissage serves to "milk" the muscle of waste products which collect due to abnormal inactivity. It assists the venous return and in given instances it will also help to free adhesions.

Two-handed petrissage to the back

Since all petrissage is preceded by effleurage as a preliminary stroke, review the effleurage stroke, first stroking lightly and then working gradually into a deep effleurage.

Now place both hands firmly on one side of the patient's back, with the lower hand ready to start its motion over the upper portion of the gluteals.

Although each hand is going to describe a circle, counter-clock-wise in direction, they do so with such timing that as one hand moves away from the spine across the muscles of the back, the other hand is moving medially toward the spine. The hands are almost *flat* as they shape themselves to the contours of the back. They pick the tissues up *between* the hands (not *with* the hands), and as they "pass" each other the forceful part of the stroke is executed as the muscles are pressed downward against the rib-cage and rolled between the hands.

After about three repetitions of this stroke in one position, progress upward by allowing the

lower hand to slide up to where the top hand has just been working, as the top hand glides upward to a new position.

Petrissage does not require much lubricant. The hands should cling to the part being massaged, picking up and pressing, sliding only when progressing, and even then with enough pressure so that fluids are carried along with the stroke.

LABORATORY IV

Variations of petrissage

There are many variations of the petrissage stroke. Since most of these are most easily done on the arm, it is a good time to learn draping and positioning of the arm.

Draping of the arm for massage

A towel or sheet should be draped across the body so that any clothing the patient wears will be protected from the lubricant. Leave the arm free but cover both the front and back of the patient. If the patient is lying down instead of seated, it is a simple matter to keep him covered with the sheet.

One-handed petrissage

For use on the smaller limbs (arms and children's legs) one hand is sufficient to use for petrissage. Place the hand *around* the part, picking up the muscle mass, using the *whole* hand. Lift the muscle away from the bone, squeezing gently upward and making small circular motions. Let the hand relax on the downward part of this small circle.

As with the two handed petrissage, the rhythm should be slow and regular. Progression upward to a new position should follow three or four strokes. As the hand progresses pressure is upward, carrying the venous return and lymph with it.

Since the biceps offers a distinctive "easy to grasp" muscle, apply one-handed petrissage to the upper arm. Let the muscle belly fit into the palm of the hand while the thumb and fingers apply pressure to the upward part of the stroke.

Alternate one hand petrissage

Another approach to petrissage of the upper arm may be accomplished by grasping the biceps in one hand and the triceps in the other. Using an alternate pattern of squeezing, petrissage both the flexors, and the extensors with a soothing gentle rhythm. As the one hand is relaxed the other is putting on pressure with the same upward, circular strokes.

In circumstances where a certain amount of stimulation is indicated, this stroke can be used to advantage, progressing rather rapidly with each stroke working always in the direction of the venous flow.

Two-finger petrissage on broad flat areas

Following the erector spinae muscle group up the back, grasp a small part between the thumb and first finger. Press it out as is done in other petrissage strokes. Although the movement is small the whole motion should come through a relaxed arm.

Alternating two-finger petrissage to the back

This type of petrissage for the back is very useful for following the direction of muscle fibers such as the trapezius. Like the above description of two finger petrissage it picks up the broad flat muscles between thumb and first finger, pressing upward with less circular motion. There is more upward progression rather rapidly pressing the fluids upward along the path of the muscle fibers.

Use both hands alternately pressing first with one hand and then the other. The thumbs overlap, so that in reality the *inside* thumb, or the thumb of one hand only, presses against the first finger of each hand, while the other thumb simply follows the movement. Some instructors call this stroke the "creepy crawl" or even "creepy mouse."

LABORATORY V

Description of friction

Friction is performed by small circular movements with the tips of the fingers, the thumb, or the heel of the hand according to the area to be covered. Small flat ellipsoids are described which penetrate into the depth of a muscle, not by moving the finger on the *skin* but by moving the tissues *under* the skin.

Purpose of friction

Friction is used to massage deep into the joint spaces or around bony prominences such as the patella. It is especially useful around a well healed scar, to break down adhesions between the skin and tissues which are beneath it. It *cannot* affect a deep fibrositis such as might form within a muscle belly.

Application of friction to the back

Arrange the patient as for a back massage and begin the treatment with effleurage and then petrissage.

Using the ball of each thumb, place one on each side of the spinous processes of the back. Any level of the back will do for a spot to learn

the technic. Press as deeply as your patient can tolerate without pain, describing small circles with a force that comes down through the arm from the shoulder. These small circles do not slide across the skin (as effleurage does), nor do they "pick-up" or "squeeze" (as petrissage does). They *press* into the tissues.

Progress upward after about three cycles, following bilaterally upward along the spinous processes in the muscular spaces between and to the side of each one. The student learning friction should never practice too long in one spot because his attempts to obtain deep pressure may cause bruising until he learns his own strength, and adjusts his technic.

Pressure follows up either side of the spine, avoiding the bony prominences. Following deep friction, effleurage stroking of the immediate area may be done with the thumbs if this technic helps the patient relax.

While the thumbs are doing the major portion of this work with this technic, the rest of the hand rests lightly on the back. It does not brace the thumb.

Variations of friction

Cross fiber manipulation

Deep friction-like strokes which apply pressure *across* the muscle fiber, rather than along the longitudinal axis of the muscle fibers can be applied to the erector spinae group of the back. Unlike typical friction strokes the thumb moves across the skin with deep short strokes.

Place one thumb close to the spinous process and stroke outward with deep pressure, and follow this stroke immediately by doing likewise with the other thumb, working thus, alternately up the back.

This type of manipulation can be done over any localized area, particularly in the presence of nodules or localized tightness.

Storms technic

Dr. Harold D. Storms of Toronto, Canada, has developed a stroke which he uses both for diagnostic and therapeutic measures, particularly for fibrositic nodules.

The cushions of the finger tips or the ball of the thumb do not slide over the skin, instead they hold position on the skin, the short stroke being made possible by moving the connective tissue *under* the skin.

This stroke varies from the previously described friction strokes in that the direction of the stroke is always parallel to the muscle fibers, rather than circular or cross-fiber in direction. Storms specifies also that as soon as the spasm *begins* to soften, massage should stop for that day. (Harold D. Storms M.D.: Diagnostic and Therapeutic Massage, Archives of Phys. Therapy, Sept. 1944, Vol. XXV, Pp. 550-552).

LABORATORY VI

Description of tapotement (more recently called "percussion")

Any series of brisk blows, following each other in a rapid, alternating fashion, come under the broad term of tapotement. Included under this heading are, hacking, cupping, slapping, beating, tapping, and pinchment.

Purpose of tapotement

It is used when stimulation is the objective, not relaxation or sedation.

Variations of tapotement

Hacking

Before reading the following instructions shake the hands, letting the wrist, hand, and fingers relax and "flip up and down." No attempt should be made to hold the fingers together, or the hands or wrist in any particular position. If relaxation is complete it will be noticed that the hands fall into a neutral plane of motion which neither supinates, nor pronates the forearm.

When relaxation is complete, an alternate direction of each arm can be started, the one moving up while the other moves down, still keeping the hands relaxed and shaking them.

Approach the patient now, holding the hands so that the palms are parallel, striking the back with a series of soft, but brisk blows, using the backs of the third, fourth, and fifth fingertips. Use both hands, striking rapidly and alternately. Done correctly the effect is one of *pleasant* stinging and stimulation.

Progress from the hips upward to the shoulder and then back downward to the hips again. For increased stimulation effect, use alcohol applied with one or two rapid, light effleurage strokes, just previous to the hacking strokes.

Cupping (sometimes called "clapping")

This stroke is applied with the same rhythmical rapidly alternating force, changing only the position of the hands to apply the blow with a cupped hand. Cup the hand so that thumb and fingers are slightly flexed, and the palmar surface contracted. Strike the back with the palm of the hand. This presumably causes a slight vacuum with each blow and

some people believe it may loosen the broad flat areas of scar tissue. It makes a rather loud noise if done correctly, which could be detrimental or useful, depending on the psychological situations at hand.

Slapping

In the same manner, but using an open rather than a cupped hand, strike gently but briskly with the fingers rather than the palm of the hand and apply.

Beating

The same stroke can be done using the hypothenar eminence of the hand, with the fist closed. Care should be taken to keep the force of the blows light and "bounding" in effect rather than jarring.

Pinchment

Likewise rapid alternate *gentle* pinching which picks up small portions of the skin between the thumb and first finger can be done.

Tapping

Tapping is done with the ends of the fingers, using sharp taps that make use of moderate fingernails, or padding the tap by using the pads of the fingers if the patient cannot tolerate the sharpness of the ends of the fingers.

Vibration

Description

A fine tremulous movement, made by the hand or fingers placed firmly against a part, will cause the part to vibrate.

Purpose of vibration

Vibration is often used for a soothing effect, particularly in treating peripheral neuritis. The treatment follows the path of the nerve. This type of vibration must be very rhythmical, using fine vibrations. It may be stimulating when more energy is applied.

Vibration applied to the back

Place one hand any place on the back with the finger tips slightly apart. The rhythmical trembling movement comes from the whole forearm, through the elbow, but the wrist and finger joints are kept stiff. The elbow should be slightly flexed. This vibrating motion should be more up and down, than from side to side. Heavy pressure should be avoided, especially if used with peripheral neuritis patients.

Variations of vibration

When following the path of a nerve for a soothing effect, an effleurage type of stroke done with just the finger-tips is employed, adding the vibration to the light effleurage stroke. Pressure can even be made so light that there is almost no contact of the hand with the part, and the vibrating hand moves almost out of contact. With extremely hypersensitive cases this technic has been credited with bringing a soothing effect.

Shaking

Another variation of vibration in a much coarser degree is useful for patients who have difficulty relaxing, it often helps to pick up the muscle belly (especially the biceps or gastrocnemius) and gently shake it back and forth causing another variation of vibration in a much coarser degree.

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Institute for Physical Therapists
November 7-11, 1955

All of those fortunate enough to attend the 1954 Institute were enthusiastic in their comments. It's down to earth — takes up your problems — answers your questions. If you do not have a registration form, ask your hospital administrator for the one sent to him or write to the American Hospital Association, 18 E. Division St., Chicago, Illinois. See program details in this issue.

The Effect of Overload on Bilateral Transfer of a Motor Skill

C. Etta Walters, Ph.D.

The clinical importance of cross education in the treatment of immobilized and nonfunctioning innervated muscles cannot be overemphasized. Since Scripture first introduced the term in 1894, the reason for the phenomenon of the gain in strength and skill of the unpracticed extremity, through training of its contralateral muscle group, has interested students of motor learning.

An excellent review of experimentation and theoretical aspects of cross education is given by Hellebrandt in the "Ipsilateral and Contralateral Effects of Unimanual Training."

Purpose

The purpose of this study is to determine the effect of overload* on bilateral transfer in a unimanual skill activity.

Procedure

The procedure is described in detail elsewhere (to be published) and, therefore, will be presented briefly in this paper.

The *Turn and Place* and *Displace Tests* of the Minnesota Rate of Manipulation Test were used. They consist of placing sixty cylindrical blocks in holes in a board and the score is the time that it takes to place them perfectly in the holes. Two timed practices were given for each test, first with the preferred and then with the nonpreferred hand.

Thirteen women, ranging in ages from 23 to 53 years, all right handed and adept with their hands, were subjects. They were equated in initial performance on the preferred and nonpreferred hand and in age and placed into two groups.

One group consisted of a control that practiced in an underload performance. Four people were in this group and practiced to a metronome which was set 12 per cent below their initial test performance. The second consisted of an experimental group that practiced in some form of overload. The subjects in the experimental classification were divided into the following groups:

1. Paced—five people practiced to a metronome, starting in underload, and progressed each day to a higher speed if they could perform four trials below a prescribed number of errors.
2. Self-paced—Four people in this group practiced at their own pacing which was the fastest they could push themselves each trial and have a perfect performance.
3. Control in Overload—At the end of four weeks, this group practiced in the manner described for Paced Overload.

Each group was trained with the right hand for four weeks, four trials daily each test, five days a week. They were tested weekly, two trials each activity with their preferred hand. At the end of the fourth week they were tested with both the preferred and untrained hand. All practices and tests were administered by the same person.

Results and Their Interpretations

Figures I and II show the comparison of the gain of the preferred and nonpreferred hand in four weeks of training. From table 1 it is evident that there is no difference in the improvement of the untrained hand of the overload group and the preferred hand of the underload subjects. Thus as much was gained by indirect practice in overload as by direct training in underload.

The mean per cent improvement of the untrained hand at the end of four weeks of training was as follows:

	Tests	
Groups	*Turn and Place*	*Displace*
Paced	16.60	15.80
Self-paced	17.75	15.50
Control	9.75	6.00

By an analysis of variance, the difference in improvement among the groups in the *Turn and Place Test* (Table 2) was not statistically significant. In the *Displace Test* (Table 3) the differ-

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This study was supported in part by United Cerebral Palsy, Chicago.

* Overload is meant here as forced learning of the skill, which in this study was primarily speed.

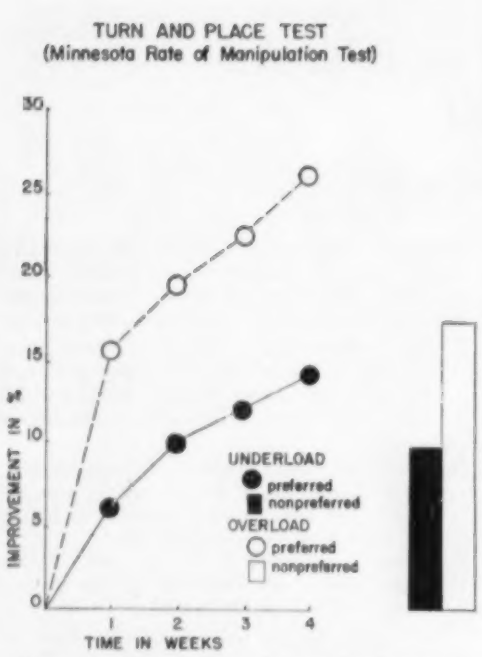

Figure 1. A comparison of the per cent improvement of the preferred and nonpreferred hand of the control and experimental groups.

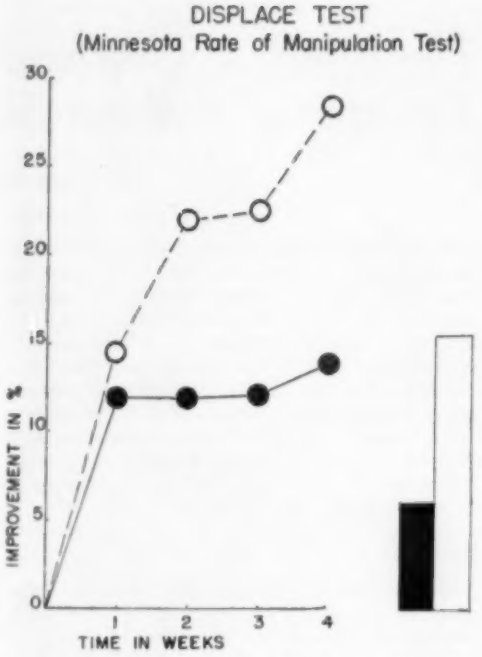

Figure 2. A comparison of the per cent improvement of the preferred and nonpreferred hand of the control and experimental groups (key is the same as in figure 1).

ence in improvement was statistically significant at the .05 per cent level of confidence.

One must examine the data and the differences in the two tests for the reason for the discrepancy of a significant difference in improvement occurring in one test and a nonsignificant difference in the other in the untrained hand.

The *Turn and Place* appeared to be a more complex skill than the *Displace Test*. It involved better coordination, more finger dexterity, and a greater reliance on vision. The Self-paced Group could push itself 17 per cent in the *Displace Test* at the end of the first week, and only 10 per cent in the *Turn and Place*.

All subjects in the Self-paced Group could push themselves every week in practice in both tests and the variations in per cent they pushed themselves were fairly uniform. Wide differences in ability to be pushed with the metronome appeared in the first few weeks of the Paced Group in the *Turn and Place Test*. One subject, who improved only 6 per cent in her untrained hand in *Turn and Place* came to the practice periods with a great many distractions. She could not stay under the predetermined number of errors in this test and practiced for two weeks in an underload performance. The last two weeks her practices were barely above the optimum test performance of the previous week. It was difficult for one other subject to throw off extraneous factors in the practice of this test, and she practiced in more optimum than overload practice up until the last week. The effect of anxiety has been shown to have an inhibiting effect on after-discharge, and the diffuseness of motor impulses in underload

TABLE 1

Analysis of Variance of the Mean Per Cent Improvement at the End of Four Weeks of Training of the Preferred Hand of the Control Group and the Untrained Hand of the Experimental Group

		Tests			
		Turn and Place		*Displace*	
Source	Degrees of Freedom	Mean Squares	F	Mean Squares	F
Between Groups	2	8		3	
Within Groups	10	47.6	.02	26.7	.112

TABLE 2

Analysis of Variance of the Mean Per Cent Improvement at the End of Four Weeks of Training of the Nonpreferred Hand of the Control and Experimental Groups in the *Turn and Place Test*

Source	Degrees of Freedom	Mean Squares	F
Between Groups	2	76.50	
Within Groups	10	44.3	1.727

and optimum load performance is known to be less than that of an overload effort. These factors may have accounted, in part, for the wide variations in improvement of the untrained hand of this group and account possibly for the non-significant difference. Practice with a metronome involves reacting to an outside stimulus and, in the case of a more complex skill and disturbing outside influences, could perhaps produce wider variations in learning patterns.

When the control group practiced in overload for three weeks, it improved over underload practice a significant 6 per cent in *Turn and Place* with the untrained hand and 4 per cent in *Displace*, which was not statistically significant.

Again, upon examination of the data in regard to the per cent pushed, this difference in the improvement in the two tests is shown to be related to the per cent pushed. As previously explained, the control group started overload practice in underload performance and progressively increased each day. The metronome markings were used as the increment gradations and the group was not actually overloaded the first week of practice and then only in small amounts the last two. *Displace*, being a simpler test, was learned faster in underload practice, and should have been forced, because of its simplicity, at a much faster rate in overload. The reason, therefore, for the difference in improvement in the two tests, appears to lie with the experimental procedure and is not in conflict with reflex patterning produced by practice in overload.

TABLE 3

Analysis of Variance of the Mean Per Cent Improvement at the End of Four Weeks of Training of the Nonpreferred Hand of the Control and Experimental Groups in the *Displace Test*

Source	Degrees of Freedom	Mean Squares	F	P
Control vs. Experimental	1	286	12.65	$<.05$
Among Experimental	1	0	0	
Experimental Error	10	22.6	5.42	$<.05$

The improvement of the preferred hand at the end of four weeks in the Turn and Place and Displace Tests (Figures I and II) was found to be statistically significant. (Data published elsewhere)

CONCLUSIONS

Statistical evidence and observation appear to justify the following conclusions applicable to similar groups.

1. The greatest transfer effects are obtained by practice in overload.
2. As much can be gained by indirect practice in overload as by direct training in underload.

Appreciation is extended to Dr. F. A. Hellebrandt for her inspiration and guidance and to the subjects who so willingly gave of their time and effort.

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Our Book Reviewers for October

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Suggestions from the Field

Table Pulley Apparatus for Shoulder Exercise

William A. Valle, B. S.

This table pulley apparatus was devised because, although we made use of the overhead reciprocal pulley for active shoulder flexion and abduction, we had no such apparatus for shoulder internal and external rotation and for elbow flexion and extension.

The table top measures 12″ wide by 28″ long. The top has a sponge rubber pad covered with wool fabric which stabilizes the elbow. The wall board is 12″ wide and 56″ high. Thirty-two inches from the bottom of this wall board the table top is attached and braced by two 1″ by 2″ boards.

The upper pulley is mounted 19″ above the table top on the wall board. A wall pulley was cut to fit under the table. The rods on which the weights slide were cut to fit into holes bored into the underside of the table top. Varied weight resistance is obtained by moving the levers which attach or detach weights.

Chief, Physical Therapy Department, Veterans Administration Domiciliary, Clinton, Iowa.

Figure 1.

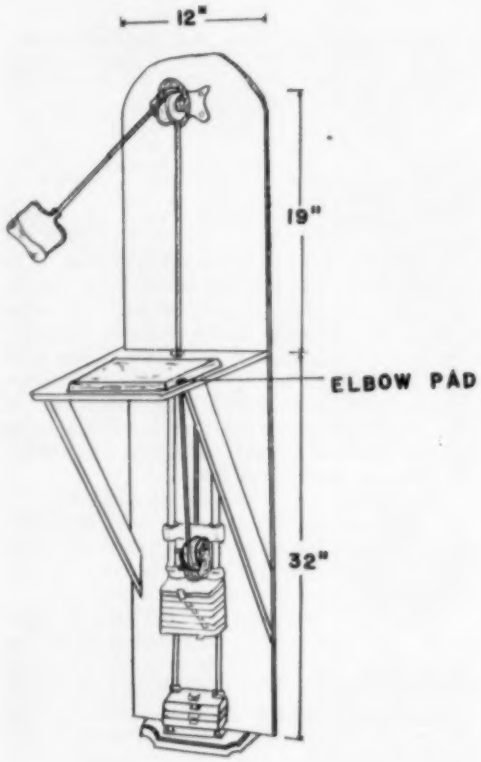

Figure 2.

One end of the pulley rope is attached to the wall board just under the table top. The rope then goes through the lower pulley and up through a 2″ hole (2½″ from wall board) in the table top and on through the upper pulley to the handle.

An alternate plan for adding weight resistance is shown in figure 2. The rope comes from the handle through the upper pulley, down through the table top hole and is tied to a metal rod. Each weight has a slit which allows it to slide on the rod.

The weight resistance used depends upon the specific exercise and the strength of the patient. This table was made narrow so that the patient

can exercise from both sides. By sitting either facing the wall or away from the wall the patient can do internal and external rotation of the shoulder.

It has been found that this active resistive apparatus combined with the overhead reciprocal pulley is beneficial for all shoulder and elbow disorders.

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(Continued on page 587)

*Fight Against Polio Is on All Fronts**

On April 12, 1955, Dr. Thomas Francis, Jr. presented his report, "An Evaluation of the 1954 Poliomyelitis Vaccine Trials" at a meeting at the University of Michigan.

The discovery of the vaccine was no small accomplishment. Nor was it the feat of a selected few. It was a cooperative effort in which the public—housewife, business man, physician, scientist, taxi driver and everyone else concerned with the health of their children worked together toward a common goal. Every individual who contributed a dime, assisted in the collection of funds, did volunteer work with patients—all feel they have a vested interest in the fight against polio and particularly the vaccine program.

This method of solving a health problem through a voluntary organization, supported by public funds, is unique. Volunteers gave the money and volunteer groups of scientists gave years of time and study to the needs in the fields of research, patient care and education to determine where these funds could be most advantageously spent. As a result of the studies, support was given to the virus typing program; tissue culture studies of Drs. Enders, Weller and Robbins; the work of Dr. Salk and his associates and many other important projects in these areas. One authority has indicated that the polio fight is years ahead of schedule and the usual situation in which it takes months and even years for new drugs or vaccines to be made available to the people, is reversed. This is largely the result of the flexibility of function inherent in a voluntary organization. This flexibility allows adaptation of the organization's program to current and changing needs. It allows for planning of long-term programs as well as for epidemic emergencies.

The importance of voluntary participation in a health program has never been more dramatically demonstrated than in the 1954 Poliomyelitis Vaccine Field Trials. Volunteers working with National Foundation Chapters throughout the country, helped to enlist the support of parents, helped to organize and staff clinics, worked with school and public health authorities and other professional groups responsible for conducting the vaccine program. Without these volunteers there could have been no field trial.

The fight against polio is not over. March of Dimes funds are needed for further research on vaccine. They will be needed to improve techniques for rehabilitation. Rehabilitation is a community responsibility which will continue to require the participation and cooperation of lay and professional groups.

There are not enough qualified professional persons to give the patients all the care they need. Through emphasis on professional education, the National Foundation is assisting professional groups to improve standards of education and practice. It is assisting professional schools to improve their facilities, curriculum and add to the trained personnel qualified to do research and take care of patients.

When the 1955 school program is completed, the National Foundation will cease its participation in the production, distribution or administration of poliomyelitis vaccine. It will continue the support of research, care of patients and education with new confidence in solving the many questions that still are unanswered.

Writing in the April 10 issue of the *New York Times*, Dr. Howard Rusk said: "It would be difficult to imagine a more dramatic gift that the people of America could make to the world than victory over polio. Particularly as it will have come as a result of democracy in action—the people willed it and sacrificed and gave to achieve it."

FURTHER POLIO RESEARCH IS ESSENTIAL

We have passed a giant milestone on the long hard road of research on polio. Many will assume that we have come to the end of the road, that no further effort in research is necessary. Actually, the job is far from being finished. Some questions have been answered but many others must also be answered before the fight against poliomyelitis can be won. Here are just a few of them.

How Long Does Immunity Last?

On December 10, 1954, Doctor Salk told a group of physicians that he had evidence of the persistence of antibodies for as long as 20 months after vaccination. Only after the passage of additional time will Doctor Salk be able to determine whether immunity as well as the presence of antibodies after three injections of a vaccine prepared in his laboratory will persist for as long as three or perhaps even five years.

Is a Booster with Live Vaccine Recommended?

It is possible that after an initial immunization

*Reprinted from the *Polio Post*, June 1955, published by the National Foundation for Infantile Paralysis for professional personnel.

with an inactivated vaccine, a booster inoculation with a live vaccine might be recommended. Answers on dosage and method of administration are not yet available. Doctor Salk does have some evidence, however, of excellent antibody response without symptoms in vaccinated children who were subsequently exposed to poliomyelitis virus under natural conditions.

Is There Any Lack of Uniformity in Vaccine Lots?

Antibody response to the eighteen lots of vaccine used in 1954 was not uniform. Some lots induced a much better response than did others. Some strains of virus were better than others. These differences indicate the necessity of discovering methods of preparing a more uniformly potent product which will not deteriorate prior to use.

How Are Kidney Cells Obtained for the Vaccine?

At present, we use kidney cells from monkeys flown from India in special cargo planes. Last year transportation for more than 30,000 monkeys cost the National Foundation several hundred thousand dollars. There may be better ways of arranging such transportation. For instance, on January 20, Dr. Joseph Melnick, of Yale University, told a group of scientists at the New York Academy of Sciences that five successful shipments of trypsinized monkey kidney cells had been made from Bombay, India, to New Haven, Connecticut. Vast numbers of living healthy monkey kidney cells are needed to grow poliomyelitis virus to make the vaccine. It is not, however, essential to transport the monkey's bones, skin and skull, when all that we require are its two kidneys. This new technique may soon be put to practical use by some of the commercial houses which are manufacturing the vaccine.

Can a Stable Strain of Normal Cells Be Obtained for Vaccine Production?

There is a possibility that some day East Indians may object to Americans and other persons removing tens of thousands of monkeys from their country to make vaccine against poliomyelitis. If a way could be found to free ourselves from dependence upon rhesus monkeys from India, and cynomolgus monkeys from the Philippine Islands, it would be a great advance. What we need is a stable strain of normal human or monkey cells, susceptible to poliomyelitis virus, which will grow continuously in cultures in this country. So important do we regard this subject that workers in six different laboratories located in Boston, Baltimore, Philadelphia, Cleveland, Minneapolis and Berkeley (California) are all searching for such a stable strain of normal cells. Certain strains have already been found which have been grown in continuous tissue cultures for as long as sixteen months, but none of them as yet are reproducing with sufficient rapidity to furnish the enormous numbers of living cells required for large-scale vaccine production.

What Is the Best Preservative for Preventing the Development of Molds in Vaccine?

In a paper by Salk, published in the February issue of the *American Journal of Public Health*, he referred to difficulties encountered with Merthiolate, the type of preservative used to prevent the development of molds in the vaccine. Further work is also needed on this important problem.

Can Vaccinated Persons Become Disease Carriers?

Grantees of the National Foundation for Infantile Paralysis are planning to study the epidemiological effects of widespread vaccination. It is necessary to know if vaccinated individuals subsequently exposed to the virus of poliomyelitis can become symptomless carriers. If so, for how long? What amount of virus will they excrete in their feces and how many times can such harmless superinfections occur? Doctor Hammon's field trials suggested that the mere presence of passive immunity resulting from gamma globulin injections did not prevent the occurrence of natural infection. We need to find out whether the same thing happens to persons who have received the vaccine.

Why Is It Necessary to Study Other Polio Vaccines?

Until we are certain that the vaccine is satisfactory from every angle, it seems only prudent to continue to support studies of other potential methods of producing immunity. For instance, Sabin of the University of Cincinnati, advocates the use of a live virus vaccine, and he is making progress towards the development of such a preparation. Much needs to be learned, however, about the best route of administration, the dosage, stability and safety of this material. It may be necessary to give live virus vaccines of the three types separately, because development of antibodies to one of them may interfere with immunization against the other two, if all three of them were given at the same time.

It has been reported by Koprowski that im-

munity to the TN strain, a Type II live virus vaccine developed in his laboratory, lasts for at least four years. Nothing is known as yet about the duration of immunity in man induced by Sabin's spinal variants. These, incidentally, are strains of poliomyelitis virus which have lost all their capacity to produce paralytic symptoms in chimpanzees by any route of inoculation. In cynomolgus monkeys, they are similarly harmless except that paralysis occasionally occurs after direct inoculation into the spine.

There is a possibility that naturally occurring strains of low pathogenicity may be uncovered by careful and systematic search of normal persons. Such strains also might be used as live virus vaccines. Other workers are attempting to reduce pathogenicity by adapting strains of all three types of poliomyelitis virus to growth in chick embryos. Finally, one worker at the California Institute of Technology is endeavoring to isolate nonparalytic strains from single virus particles, and he is making some headway in this approach.

Are Studies in Chemotherapy and Chemoprophylaxis Still Needed?

As long as administration of the vaccine is restricted to children whose parents sign a request form, there will always be some youngsters who, for religious or other reasons, will not receive the benefits of this type of immunization. Furthermore, unless vaccination actually eradicates the virus, which seems most unlikely, poliomyelitis virus will continue to circulate among immune as well as non-immune persons. In dealing with future sporadic outbreaks of the disease it would be of great value if a drug were known which, if given early enough following exposure, might prevent paralysis, or if given after the onset of illness might alleviate the severity of the attack.

Two approaches to this problem are now being followed, empirical trials and a metabolic line of attack. Under the first method hundreds of likely chemical compounds are screened in tissue cultures. Those substances which prevent the death of monkey kidney cells or of HeLa cells when exposed to virus are tested further in live monkeys fed virus by mouth. Some of the results of this type of study were reported recently.

At other laboratories the investigators are searching for chemical substances which alter or adversely affect the growth of virus or of living cells, reasoning that such materials might perhaps likewise affect poliomyelitis virus and its multiplication in such cells.

What Progress Is Being Made in Improving Diagnostic Tests for Polio?

It is often highly important to find out as quickly as possible whether any suspect illness actually is poliomyelitis. Two kinds of tests are currently in use for this purpose; isolation of the virus and antibody determinations. Estimates of the amount of antibodies developed are also necessary in assessing the effectiveness of any vaccine under trial.

In 1953, it was discovered that the HeLa strain of cancer cells was singularly susceptible to poliomyelitis virus. One of the outstanding advantages of using HeLa cells is that they multiply very rapidly in tissue cultures and are available in unlimited numbers in this country. When we use HeLa cells, we are not dependent therefore upon monkeys imported from India.

HeLa cells placed in the presence of poliomyelitis virus die in two or three days, whereas if blood serum containing antibodies is added simultaneously with the virus, the cells do not die. It is thus possible to measure the amount of virus or conversely the amount of antibodies present in any sample of a biological material. All that is necessary is an examination of the preparation in a microscope to see whether the HeLa cells have died or not. This type of test was widely used in the evaluation of the vaccine.

Another new diagnostic test is the color test devised by Salk. This depends upon the use of trypsinized monkey kidney cells. As such cells in uniform suspension grow in a nutrient medium, they develop acid, and this causes the medium to become yellow. If virus is added, it kills the cells so they cannot develop normally and produce acid. Thus the phenol red containing medium remains pink. Similarly, if virus and antibodies are added, then the antibodies neutralize the virus which, accordingly, does not destroy the living HeLa cells. Instead, metabolism proceeds in a normal manner; acid is formed; and the color changes in a few days to yellow.

In this ingenious and valuable test, therefore a decision about the amount of virus or of antibodies present can be made by observing a color change from pink to yellow or vice versa. No microscope is needed.

Another diagnostic test also coming into the fore is the complement fixation test. This test is now receiving intensive study in several laboratories in this country, in some of which it is being used routinely for epidemiological investigations. The complement fixation test measures antibodies not virus, and the kind of antibodies

that are measured are not identical with neutralizing antibodies. Nevertheless, certain complement fixation tests, notably the Wassermann reaction, have proved to be of very great value in the past for the serological diagnosis of other ailments such as syphilis.

How Does the Poliomyelitis Virus Invade the Body?

The obvious necessity of obtaining more precise knowledge about the exact mechanism by which poliomyelitis virus invades the human body remains an essential aspect of the Research Program. At one laboratory in Baltimore and another in New York, progress is being made in learning more about this aspect of the disease, initially in experimental animals.

Bodian, at a recent symposium on the Biology of Poliomyelitis, told about his painstaking examination of all the internal organs of several chimpanzees, originally infected by mouth, before those animals had reached the stage of viremia. He found evidence in them of virus multiplication in the intestinal tract, in two groups of lymph nodes and in the tonsils.

Shwartzman, at Mount Sinai Hospital in New York, has demonstrated in hamsters and cynomolgus monkeys that considerable multiplication of virus takes place in deposits of what he calls brown fat, even before virus gets into the blood stream. Further work along these lines should indicate the possible importance of these various mechanisms in the disease process as it affects human beings.

What Are Some of the Characteristics of the Poliomyelitis Virus Itself?

Investigators are studying the mechanisms of attachment of virus particles to susceptible cells; how penetration takes place; and what are the chemical changes brought about in such cells by virus invasion? Can certain cells develop a resistence to virus invasion? What happens if virus particles of two different types invade the same cell? Do virus particles ever lie dormant inside cells and only escape after a suitable stimulus has been applied? What are the stimuli that might conceivably bring about the release of quiescent virus particles? These and similar questions may be answered in due course by biochemical and biophysical investigations which are going on in a number of universities under grants supported by the March of Dimes.

Health Forum Summary Now Available

"Signs of the Health Times," a 64-page condensation of what was said during the 1955 National Health Forum on Forecasting America's Health, March 23 and 24, is now available from the National Health Council. Members of the Council, of which the American Physical Therapy Association is one, conduct the Forum each spring to consider health questions of broad reach.

The report offers swift summaries of the present, and expectations for the future, in many areas of information that any planner of health programs must take into account, including:

- —economic trends and their probable effects on health efforts
- —what atomic developments mean healthwise
- —new miracles to expect from medical science, and how social science can help us benefit from them
- —the health manpower situation and NHC's Health Careers program
- —the role of mass communications media in health betterment
- —fluoridation as a unique public health case-history-in-the-making and as an opportunity to study the interaction of community health forces
- —what communities can do about chronic illness
- —probable impact of the Hoover Commission's health recommendations

Roscoe P. Kandle, M.D., Forum chairman, points out in the introductory pages that, basically, the 1956 Forum sought to erect new guideposts to more effective cooperation among the rapidly multiplying and widely varied health organizations in this country in working together for the American people.

"I feel sure we succeeded in painting useful road signs to health action both in the community and elsewhere," says Dr. Kandle.

The report, printed in two columns on 8½" x 11" pages with two-color cover, is being mailed to Forum registrants. It may be secured for $1 per copy from the National Health Council, 1790 Broadway, New York 19, N. Y. Reduced prices are offered for quantities.

Editorial

One of the most natural manifestations of growth and expansion of an association is the appearance of diversification of major interests within the group. Emphasis is bound to direct itself toward the varied interests, responsibilities, and problems which present themselves to each individual in his daily work situation. In the early stages of an organization's development there is generally a noticeable similarity of purport, objective, and aim—a unity of purpose. This is right and proper since sound development can only be successful when there is such a unity. With continued growth, however, *specific* interest areas develop and when properly integrated with the whole group become a potent force for success.

In the past few years the American Physical Therapy Association has been experiencing such "growing pains." The first concrete example of this was the group of our membership responsible for the education of physical therapists, in contrast to those having to do with service to the patient. As a result, the first specific interest group was the School Section. Although the first meeting took place in 1940, the Section became a reality and an integral part of the Association's structure in 1948 through an amendment to the Bylaws. Recognizing the value of such groups in 1954 the House of Delegates further amended the Bylaws relating to Sections to make it more meaningful and workable. This year we find ourselves in the process of developing a second section, one concerned with members who are self-employed.

There is little question of the value of the meeting together of members with mutual interests and problems to the continued development of the profession. Their careful study and discussion of their own needs and objectives and their sharing of experiences serve to strengthen themselves individually and collectively as well as the whole Association. In the future it is highly probable that other sections will appear when a sufficient number of members with common interests in a specified area feel that need.

According to our Bylaws, the purpose of Sections is to "serve as conference groups to promote and develop their objectives as they relate to the objects and functions of the Association." Within this framework are two very important concepts, the understanding of

Editorial

which should add to the success of any such group within our organization.

In order for a Section to function successfully it is important that there be an awareness of the responsibilities inherent in the phrase ". . . promote and develop their objectives . . . ." It is immediately apparent that this requires the members of the section to identify realistic and necessary objectives relating to their own problems. It also gives them the responsibility of keeping these objectives currently and advisedly under scrutiny and of communicating their studied conclusions to the association as a whole. This is an excellent and democratic procedure if properly interpreted.

The second part of this purpose must be emphasized too if we, as a profession, are to realize the greatest return from their existence. The phrase referred to is ". . . objectives as they relate to the object and functions of the Association." In all business proposed and determined through Section meetings it is of paramount importance that each of us remember that regardless of personal interests and special concerns, we are primarily physical therapists and members of a united profession. There must be constant awareness of the dangers of shortsightedness and narrowness in point of view.

It is a healthy sign to see the growing need for the opportunity for those with like and specified interests to meet together. It indicates maturity and growth in scope of our profession. But let us not lose sight of the whole as it relates to the parts. Sections are part of the American Physical Therapy Association and as such depend upon it and contribute to it. Sections can be likened to the facets, our Association to the gem. The more skillfully they are cut and placed the more value they lend to our profession and its service to mankind.

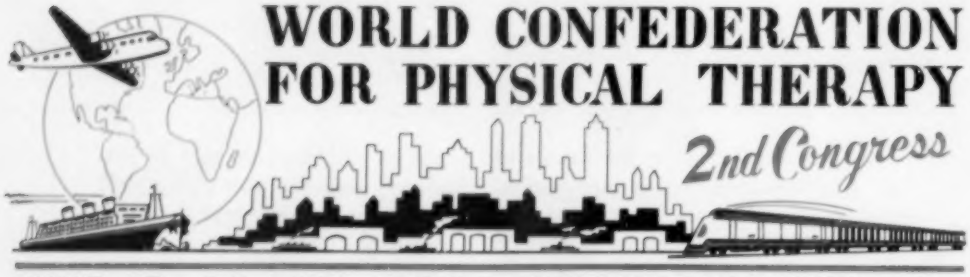
Announcement of 1956-57 Program for Italy under the Fulbright Act.

While the list of openings is tentative, the Committee on International Exchange of Persons believes that it may be helpful to those interested in applying for awards under the 1956-57 program in Italy. The American Commission for Cultural Cooperation with Italy has indicated that there may be changes in specific openings and that more information may later be expected on some of them; nevertheless, the final program will probably not differ greatly in its essential outlines from what follows:

Occupational and Physical Therapy. (One award in each field)

Two lecturers are requested to take part in a developing program at the School of Occupational Therapy, Clinic of Mental and Nervous Diseases, University of Rome. The School desires specialists in work either with children or adults who have had considerable teaching experience, and who have also had experience in the organization and supervision of programs. In both cases a knowledge of Italian is desirable. The specialist in physical therapy would work particularly with cerebral palsy patients, and would be asked to give demonstration lessons and instruction in general physical therapy theory.

Apply to: Conference Board of Associated Research Councils Committee on International Exchange of Persons. Mailing address, 2101 Constitution Ave. N.W., Washington 25, D. C.—Office Address 1785 Massachusetts Ave. N.W. Washington 6, D. C.



WORLD CONFEDERATION FOR PHYSICAL THERAPY

2nd Congress

JUNE 17—23, 1956 · HOTEL STATLER · NEW YORK, N.Y.

Intermediate Program

Sunday, June 17

11:00 a.m.	Religious Services
2:00 - 5:00 p.m.	Registration
5:00 - 8:00 p.m.	Reception

Monday, June 18

Morning	Registration Opening Ceremony
Afternoon	Summaries on status and needs in physical therapy by principal observers from governments. Coordinator: Morris Fishbein, M.D.
Evening	Boat trip around the Island of Manhattan. Host: New York Chapter

Tuesday, June 19

Morning	"Health, A Strong Force for World Understanding—The Role of the Physical Therapist" Howard Rusk, M.D. "The Physical Therapist — His Education and Responsibilities" Catherine Worthingham, Ph.D. "The Physical Therapist — His Relationships to his Fellow Workers and the Community" Colonel Harriet S. Lee
Afternoon	Two Concurrent Sessions

Session A

Panel Discussion — The Role of the Physical Therapist in the Evaluation Studies of Polio Vaccine Field Trials
Cerebral Palsy: Similarities and Differences in Methods of Treatment

Session B

Panel Discussion — Prosthetics — Research and Developmental Aspects and Training

Wednesday, June 20

Morning — Two Concurrent Sessions

Session A

—Principles of Underwater Exercise
—Therapeutic Use of Water
—The Physical Therapist on the Obstetrical Team (Great Britain)

Session B

—Symposium on Body Alignment as Related to Activity
—Posture and the School Child (Denmark)
—Posture in Industry (Sweden)
—Posture and Pain (England)
—Exercises for Bechterew's Disease (Germany)

Afternoon — Two Concurrent Sessions

Session A

—Symposium — Selected Testing and Evaluation Procedures
—Development and Current Use of Manual Muscle Testing in the United States
—Development and Current Use of Functional Testing in the United States
—Electromyographic Studies
—Joint Measurement — Technics and Recording Methods

Wednesday, June 20

Afternoon

Session B

—Physical and Physiological Effects of Introducing Heat to Living Tissues

—Physiological Basis for Heat

Evening — Banquet

Thursday, June 21

Morning — The Patient and the Physical Therapist in the Community's Rehabilitation Program — Symposium

The Patient as a Person

Canadian Home Care Program

Convalescent Program for the Severely Disabled

Utilization of Community Resources for Rehabilitation

Afternoon — General Meeting of the W.C.P.T.

Friday, June 22

Morning — Three Concurrent Sessions

Session A

—Symposium — Bracing and Adaptive Devices for Neuromuscular Disorders

Session B

—Educational Seminar

Session C

Papers from member societies of the W.C.P.T.

Afternoon — Panel Discussion — Responsibilities of the W.C.P.T.

Closing Ceremony

Film Theatre

Beginning Tuesday, June 19, there will be a daily schedule of films from abroad and this country.

Study Visits

Study visits will be scheduled to selected centers in New York City on two or more afternoons.

Social Events

The calendar of social events is not yet complete. In addition to planned receptions there will be New York with its Broadway, Times Square, Television and Radio Studios, Sightseeing, Theaters and Museums.

Post Congress Tours

Two tours are being planned which will combine professional visits with sightseeing. One to Washington, with a stopover in Philadelphia. One to Boston with a stopover en route.

Educational Courses

There will be opportunities before and after the Congress for those wishing short refresher courses. Watch the Review for further details.

University of Connecticut

Post Congress Course — June 25-30, 1956. The University of Connecticut School of Physical Therapy is offering a five-day course on recent advances in upper extremity prosthetics including basic kinesiology, amputation levels, prosthesis, harnessing, and training. Cost, $80.00 for tuition, room and meals. Accommodations will be available on campus.

The faculty will include Dr. Charles Bechtol and staff of the Physical Therapy School, University of Connecticut.

For further information and application write to Frances Tappan, Technical Director, School of Physical Therapy, University of Connecticut, Storrs, Connecticut, U.S.A.

Kessler Institute

A post-Congress four-to-five day institute is being planned.

• • •

Enroll Now

Send in your enrollment form prior to February 1, 1956. Early enrollment will help your planning committee. If you failed to receive your form, write to the National Office.

Membership Categories

Full Members — Physical therapists, occupational therapists, medical social workers, physicians, vocational counsellors, nurses, administrators of hospitals and rehabilitation centers, board and staff members of organizations interested in the handicapped.

Student Members — Students in the approved

schools of physical therapy in the member organizations of the World Confederation for Physical Therapy.

Social Associates — Members of the family or friends of a full member. This will permit attendance at general meetings, visiting exhibits, and participating in a social program prepared for them during time of scientific sessions.

Membership Fees

Until February 1, 1956	
Full Members	$10.00
Student Members	5.00
Social Associates	8.00
After February 1, 1956	
Full Members	12.00
Student Members	6.00
Social Associates	10.00

Members who have enrolled but who are subsequently unable to attend may have their fees refunded less 20 per cent, provided cancellations are received by May 1, 1956.

Hotel Reservations

Statler reservation cards will be sent out in February 1956.

Contributions

The International Poliomyelitis Congress has generously contributed $3,500 to the World Confederation. This great support is most welcome and heartwarming.

New Chapter Contribution

Vermont Chapter contributed $9.00, coming to 38 per cent of their quota.

New Endorsing Organizations

American Academy of Orthopaedic Surgeons
American Orthopaedic Association

Letters of Indorsement

DEPARTMENT OF
HEALTH, EDUCATION AND WELFARE
OFFICE OF VOCATIONAL REHABILITATION
WASHINGTON, D.C.

June 20, 1955

Dear Miss Elson:

Thank you for sending the preliminary program for the Second Congress of the World Confederation for Physical Therapy to be held in New York City June 17-23, 1956.

Needless to say we are delighted to know the Congress will convene in the United States. It is a wonderful opportunity to be associated with and meet personally therapists from all over the world. It is through meetings like this when we discover through our common professional interests the similarity of problems, hopes and goals that we realize the true unity that exists between people of all nationalities.

The program plans and broad international representation hold promise for an unusually fine conference. Please be assured of our good wishes and desire to participate to the fullest extent possible. Will you extend to the participants who are coming to Washington our cordial invitation for them to stop in and visit us. We would like very much to meet with as many of your group as possible.

Sincerely yours,

Signed: MARY E. SWITZER
Director

DEPARTMENT OF
HEALTH, EDUCATION AND WELFARE
WASHINGTON

June 22, 1955

Dear Miss Elson:

The Department of Health, Education and Welfare congratulates the World Confederation for Physical Therapy on the convening of its Second World Congress and is pleased that the Confederation has chosen the United States for its June 1956 session. The common basis of professional knowledge, experience and aspirations of a group such as this will do much to further international understanding and strengthen the bond of friendship between people of the many nationalities participating.

The benefits of this international meeting will be far reaching—going beyond your professional group to the vast numbers of lay and professional people associated with it in one way or another. We will look forward with keen interest to the proceedings and extend to the participants of the Congress a cordial invitation to visit the Department while they are in the United States.

Best wishes for success of the Congress.

Sincerely yours,

Signed: BRADSHAW MINTENER
Assistant Secretary

Association Activities

Barbara White

Barbara White Appointed Consultant in Office of Vocational Rehabilitation

Barbara White, who was Field Secretary and Education Consultant for the Association, 1946 to 1949, Vice-President 1944 to 1946, who has served on various national committees and as an officer for the Hawaii, New York City and Connecticut Chapters, resigned from her position on the Connecticut Crippled Children's Department on May 1 to become Physical Therapy Consultant, Office of Vocational Rehabilitation, Department of Health, Education and Welfare. This is a new position in the OVR and one to which Miss White brings a wealth of experience.

Public Law 294

The "Bolton" bill was enacted into law in the final days of the 84th Congress.

This law changes the name of the Women's Medical Specialist Corps to Army Medical Specialists Corps and makes Reserve commissions possible for men as well as women within the authorized strength of the Corps.

No directives regarding its implementation have yet been received. Inquiries regarding Reserve commissions in physical therapy should be directed to the Army Area Command of the individual's residence.

Bronze Star Medal for Physical Therapist

Major Elizabeth C. Jones, AMSC, chief physical therapist of Tokyo Army Hospital, Japan, was awarded the Bronze Star Medal for meritorious service there from September 1953 to July 1954 at a recent ceremony in Tokyo. During that period a polio epidemic occurred in the area and, in addition to Army personnel, many United Nations patients were afforded specialized treatment under Major Jones' supervision.

Major Jones, of Rochester, Minnesota, has been an Army physical therapist since 1942 when she completed the clinical phase of physical therapy training at Stark General Hospital, Charleston, S. C. She is a graduate of The Occupational Therapy Course, Milwaukee Downer College, Wisconsin, the Mayo Clinic Physical Therapy Course, and has attended the specialized course at Warm Springs, Georgia.

Next September Major Jones will return to the States to become the chief physical therapist at Madigan Army Hospital, Tacoma, Washington.

Akron, Ohio
August 8, 1955

To the Editor:

Pat and I enjoyed so much our visit to the National Office of the American Physical Therapy Association. It meant a great deal to me to meet and talk with you and the other members of the staff. Now "1790 Broadway" means more than just an address to me. At first I hesitated visiting the office but after doing so I was very glad I had not missed my opportunity. You were all so sincere in making me feel welcome. Please give my regards to the others whom I met.

Mrs. Grace Aho Cinquemani, a graduate of the University of Wisconsin, September, 1952, who had been working at the Hinsdale Sanitarium, Hinsdale, Illinois, was tragically killed recently in an automobile accident. Her husband and three months old baby survive.

Marriages

Constance Bergstrom of Chicago, Ill., now Mrs. Constance B. Eiser, Blacksburg, Va.
Patricia Bodurtha of Agawam, Mass., now Mrs. Patricia B. Whitney, Agawam.
Agnes R. Brady of Newport, R. I., now Mrs. Agnes B. Clarke, Providence, R. I.
Julianne Cunningham of West Hartford, Conn. to Charles Steffens Jr., Glastonbury, Conn.
Juliet Ernst of Cheyenne, Wyo., now Mrs. Juliet E. Thomas, Cheyenne.
Martha Freeman of Providence, R. I., to James C. Brewer Jr., Durham, N. C.
Mary J. Grabner of Minneapolis, Minn., now Mrs. Mary G. Arnison, Anoka, Minn.
Eleanor Hoffman of Ann Arbor, Mich. to W. H. Kelton Jr., Stonington, Conn.
Kathleen M. Johnson of Berkeley, Calif., now Mrs. Kathleen J. Horr, Richmond, Calif.
Marilyn Kidder of Storrs, Conn., now Mrs. Marilyn K. Marchant, Manchester, Conn.
Lisa Kolb of Grand Rapids, Mich., now Mrs. Lisa K. Sumner, Grandville, Mich.
Mildred Lawrence of Springfield, Ill., now Mrs. Mildred L. Prather, Springfield.
Dorothy McCaw of Seattle, Wash., now Mrs. Dorothy M. Carter, Seattle.
Harriet M. Moore of Richmond Heights, Mo., now Mrs. Harriet M. Schafer, Chicago, Ill.
Jeanette A. Nichols of Bridgeport, Conn. to B. S. Middlebrooks, New York, N. Y.
Dorothy O'Connor of Springfield, Mass., now Mrs. Dorothy O. Brown, Springfield.
Linnea Peterson of Menlo Park, Calif. to Stephen W. Bennett, Palo Alto, Calif.
Alma M. Roberts of Governor's Island, N. Y. to Joseph K. Boyne, Columbus, Ga.
Ellen Sansone of New Haven, Conn., now Mrs. Ellen S. Sutton, East Haven, Conn.
Joan A. Schleck of Oakland, Calif. to C. D. Blalock, Oakland.
Barbara Schweinshart of Attleboro, Mass. to Chester A. Stoeckel, Little Compton, R. I.
Gloria Sipe of Pittsburgh, Pa. to Shelden Siegel, Berkeley, Calif.
Nancy Joan Smith of Swampscott, Mass. to Richard C. Peterson, Marblehead, Mass.
Joan C. Tangen of Randolph, Mass. to William C. Cummings, Randolph.
Hazel Tarrant of Yalesville, Conn., now Mrs. Hazel T. Hall, West Hartford, Conn.
Margaret A. Vance of Charlotte, Mich. to George E. Dillinger, Topeka, Kans.
Shirley L. Wilson of Imperial, Pa. to Milton H. Spees, Denver, Colo.

Announcement of Regular Corps Examinations for Physical Therapy Officers United States Public Health Service

Competitive examinations for appointment of physical therapists as commissioned officers in the Regular Corps of the U. S. Public Health Service will be given at central points over the country November 15, 16, and 17, 1955. Applicants will be examined at the centers nearest their homes. Applications close October 15, 1955.

Physical therapists who pass the examination will be eligible for staff and supervisory positions in Public Health Service Hospitals and outpatient clinics, and in the National Institutes of Health.

Officers in the PHS commissioned corps have ranks equivalent to Naval officers, and are paid according to the same scale. The coming examinations will be for Junior Assistant Physical Therapists (equivalent to ensign), Assistant Physical Therapists (lieutenant j.g.), and Senior Assistant Physical Therapists (lieutenant). Entrance pay for these positions range from $4,268 to $6,017 per annum.

Therapist officers appointed will receive periodic pay increases, 30 days of annual leave, sick leave as necessary, medical care, disability retirement pay in case of disability, and retirement pay equal to three-fourths of their annual basic pay at the time they retire.

Applicants for the Junior Assistant Therapist grade must be citizens of the United States, have a bachelor's degree in physical therapy from an approved school, or a bachelor's degree and a certificate in physical therapy from an approved school. For Assistant Therapist grade, applicants must meet the requirements for Junior Assistant grade and have at least three additional years of professional training and experience (a minimum of seven years). For Senior Assistant Therapist grade, applicant must meet the requirements for the Junior Assistant grade, and have at least six additional years of professional training and experience beyond the bachelor's degree (a minimum of ten years), and have had a minimum of one year's experience in *supervision* or in *administration* of a physical therapy program.

Application forms and further information can be obtained from the Division of Personnel, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C. Applicants will be notified where to go for examinations. The examinations will include oral interviews, physical examination, and comprehensive objective examinations in the professional fields.

Conference Banquet, Jefferson Hotel, St. Louis, June 1955

Institute for Physical Therapists

Dates: November 7-11, 1955 inclusive

Place: Penn-Sherwood Hotel, Philadelphia, Pennsylvania

Sponsors: American Hospital Association and American Physical Therapy Association

Tuition: $35.00

The program for the Institute for Physical Therapists has been developed cooperatively by the sponsoring organizations. A committee from the Eastern District of the Pennsylvania Chapter composed of Rheta Adams, Chairman, Dorothy Baethke, Mary DuVally, Francis Naselli, and Norman Schneck is serving for the host area. The faculty of the Institute will include physicians, hospital administrators, physical therapists, occupational therapists, and nurses.

November 7

Monday A.M.

Registration
Greetings
Basic Hospital Organization

Monday P.M.

Organization and Administration of the Physical Therapy Department
Community Resources for Rehabilitation
How does the Physical Therapist Participate in Community Planning for Rehabilitation

November 8

Tuesday A.M.
Medical Direction
Medicolegal Aspects

Tuesday P.M.
Physical Therapy Department Records — Administrative and Professional Safety Practices

November 9

Wednesday A.M.
Evaluation Clinic

Wednesday P.M.
Office of Vocational Rehabilitation
The Physical Therapy Department — Its Clinical Teaching Responsibilities
Basic Principles of Supervision

November 10

Thursday A.M.
The Financial Management of a Physical Therapy Department
Hospital Accreditation

Thursday P.M.
Utilization of Personnel:
Professional
Nonprofessional Paid
Volunteer

November 11

Friday A.M.
The Nurse and the Physical Therapist: Cooperative Relationships
Luncheon—Awarding of certificates

Application forms will be sent to every active member of the Association. Applicants must be members of the American Physical Therapy Association or personal members or on the staff of an individual member of the American Hospital Association. Attendance is limited to 100 persons.

New Student Members

Geraldine Morrison ..... *Stanford University*
Phyllis Bartell ..... *University of Connecticut*

Institute for the Crippled and Disabled Makes Preliminary Announcement of Second Training Program for Administrators

The second training program designed to prepare people in rehabilitation for top level positions of coordination and administration in rehabilitation centers has been announced on a tentative basis by the Institute for the Crippled and Disabled, rehabilitation center in New York City.

The proposed starting date for the seven-month course is December 1, 1955. Applications received by October 15th will be given preference.

In making the announcement, Willis C. Gorthy, Director of the Institute, said that final determination on conducting the course will be made by October 1st.

Mr. Gorthy said that persons presently engaged in rehabilitation center supervision and administration, and those who have commitments for this type of employment, will be given priority for enrollment.

The training program is designed to meet an urgent need for people equipped to administer and coordinate the complex operations of a comprehensive rehabilitation center which specializes in the problems of the very seriously handicapped.

"Throughout the country, communities are developing a broad interest in establishing comprehensive facilities to care for their handicapped," Mr. Gorthy said. "The Federal Government's long range program for the development of rehabilitation centers has added greatly to the forward movement of this effort. The training of competent personnel to convert these plans into real benefit to the handicapped, and to their communities, is essential to the success of this nationwide program."

Applicants for the course should have had at least three years' experience in such fields of rehabilitation as: health council groups, public health administration, personnel administration, vocational rehabilitation, medicine, occupational therapy, physical therapy, speech therapy, counseling psychology, social work, crippled children services, hospital or welfare institutional administration and special education.

The training will begin with an initial period at the Institute for the Crippled and Disabled, during which the trainees will be given basic orientation in rehabilitation center management, as well as indoctrination in the relationships of the many professional disciplines which comprise the modern rehabilitation center.

Following this, each trainee will receive three on-the-job training sessions at selected rehabilitation centers throughout the country. Between each session, the trainees will return to the Institute for evaluation of their experiences and further instruction in the administrative and management areas of rehabilitation center operation.

Trainees will receive a stipend of $250.00 per month for the seven-month period, in addition to round trip travel expenses from the Institute to the places of on-the-job training. All other expenses will be borne by the trainees.

Except in cases of unusual qualification, trainees must be between 30 and 50 years of age.

A preliminary announcement of the training program has been published by the Institute. Copies and additional information may be had on written request to the Director, Institute for the Crippled and Disabled, 400 First Avenue, New York 10, N. Y.

Member Co-Author of Paper in *Journal of Bone and Joint Surgery*

Henry O. Kendall, a member of the American Physical Therapy Association since 1933, is co-author, with Dr. J. T. H. Johnson of the Johns Hopkins Medical School, of the article, "Isolated Paralysis of the Serratus Anterior Muscle," in the *Journal of Bone and Joint Surgery*, June 1955.

Mr. Kendall and his wife, Mrs. Florence Kendall, are active in the Delaware Chapter and the Association. Together they have written many articles and pamphlets, including, "Care During the Recovery Period in Paralytic Poliomyelitis," for the *Public Health Bulletin*. In 1949 they collaborated on the book, "Muscles — Testing and Function," and in 1952, with Dorothy A. Boynton, they wrote the book, "Posture and Pain."

An abstract of the article from the *Journal of Bone and Joint Surgery* appears in this issue of the *Physical Therapy Review*.

General News

Iowa Research Finds Children's Muscles "Fit"

Television and other "sitdown" activities haven't yet made weaklings of most American children, despite widely published reports to the contrary.

So says a State University of Iowa research team, whose members administered the Kraus Muscular Fitness Tests this spring to 575 normal, healthy children in grades one through six. These are the same tests which gained national attention last year and again recently when their originator declared that American children tested were far inferior in muscular fitness to European children. (See abstract, September 1954 Physical Therapy Review, page 491.)

Janet Atwood, graduate student at State University of Iowa, gave the tests and reports her findings in her thesis for the master's degree which she will receive next month. Miss Atwood and Margaret Fox, associate professor who directed the thesis study, completed the two-day course of instruction for administering the tests and were authorized to give them by their originator, Dr. Hans Kraus of New York University.

Miss Atwood and Dr. Fox found that the Kraus method required a child to pass all of six tests for a variety of muscular traits, giving no credit for partial success in any of the tests. So they feel that the test results far underestimate the muscular strength and flexibility of children tested.

They point out that to say that a child has failed these tests of muscular fitness as a whole because he cannot pass one of them with a score of 100 per cent is as unrealistic as calling a child feebleminded because he can't pass a quiz on mathematical skill or vocabulary mastery in a series testing his intellectual capacity.

They also found the test weak in its emphasis on the importance of "flexibility" as a part of muscular fitness in children. European children, youngsters in the eastern U. S. tested by Dr. Kraus, and the 575 Iowa City children tested all came out with a much higher percentage of failures on the one flexibility test included than on the other five tests.

Many more children in both American groups failed the flexibility test than did the Europeans, with 57.9 of the Iowa City children failing it, 44.3 of the Eastern children and 9.1 of the Austrian, 6.1 of the Italian and 8.4 of the Swiss children failing to pass this test.

The flexibility test is a simple one: the child stands erect in his stocking or bare feet, puts his feet together and leans down to touch the floor with his fingertips, keeping his knees straight and holding this position for three seconds. Under the Kraus system of scoring, no credit is given for being able to touch the toes or come close to the floor.

The Kraus method requires the tester to tell the child to "bend over as far as you can," without suggesting that he try to touch the floor. Both Dr. Fox and Miss Atwood feel that the additional challenge of simply suggesting to the child that he try to touch the floor would get much better results on the test.

Dr. Fox points out that the greater spurts in growth of American children—due partly to better nutrition—should be expected to lessen their flexibility, which they regain as they get into the 'teens and muscle growth catches up with bone growth.

Expecting maximum flexibility in the child's muscles while his bones are growing rapidly is like trying to stretch the same rubber band with an increasingly longer stick, they say. If you make the stick enough longer, the band just won't "give" much. This imbalance of growth between muscles and bones partly accounts for the awkwardness recognized as typical in junior high school children.

The shorter height of southern European children and adults as compared to Americans means they are subject to less intensive spurts of growth and so should be expected to retain more flexibility during the growing period.

Miss Atwood found that physical education classes tend to increase the muscular fitness of grade school children. She reported an approximately 70 per cent failure to pass all of the tests by children in schools which have not had regular physical education programs during the entire time the children were enrolled.

This percentage of failure dropped to 56.8 in a school which has had physical education class-

for some time, which is 1.1 per cent fewer failures than those of children tested by Dr. Kraus in eastern cities and suburban areas.

In general, Iowa City girls ranked better on the tests than boys particularly in flexibility. Iowa City children failed less often than easterners in the tests for strength of abdominal, psoas (hip joint flexor) and back muscles. The Iowa City youngsters ranked lower than easterners on the flexibility test, possibly suggesting more rapid growth.

After flexibility, the second cause of failure for the Iowa City children was testing for abdominal strength, which calls for doing two "sit-ups," raising the upper part of the body to a sitting position while the tester holds the child's feet down. In one situp the legs are extended out straight, while in the second one, the knees are bent, with the feet flat on the floor. However, only 22.4 per cent of the Iowa City children failed either of these tests.

Despite these findings, the State University of Iowa department of physical education for women would not encourage a complacent attitude toward the need for children's exercise. In fact, previous studies in the department have shown the need particularly for more exercise of the arms and shoulder girdle muscles, which, incidentally, are skipped in the Kraus tests since the latter tests check only the musculature of the trunk, or those muscles used in maintaining good posture of the trunk.

As a result of earlier SUI studies the department has long advised parents and schools to provide apparatus encouraging climbing and hanging activities for grade school youngsters. This advice would seem to be reinforced by Miss Atwood's recent finding that children who had been in regular physical education classes scored higher as a whole on the Kraus tests, thus indicating the value of these classes.

But she and Dr. Fox believe that the conjecture that American children are muscular weaklings because a large percentage of those tested to date couldn't pass all six of the Kraus tests probably doesn't have solid foundation in fact.

Crippled Children's Program

Thousands of adults able to pursue productive and satisfying lives today owe their chance for this to the help that State Crippled Children's Agencies gave them in childhood and to great technological advances in treatment in the past 20 years.

Progress in these two directions in the two decades is reviewed by Dr. Edward Davens, Maryland Department of Health, in the July-August issue of *Children*, professional journal of the Children's Bureau, U. S. Department of Health, Education, and Welfare.

State programs for crippled children, where they existed in 1935, were limited to treating children with orthopedic handicaps. Since then, every state has developed a program, and all have opened their doors to at least some children with other handicapping conditions, such as epilepsy, cerebral palsy, congenital heart disease, rheumatic fever, eye and ear conditions, cleft palate, diabetes, etc. An estimated 271,000 children received medical attention in 1954.

During this 20-year period, states have received technical assistance and annual grants from the Children's Bureau. These grants, authorized by the Social Security Act whose 20th anniversary occurred August 14, 1955, started at about $2,850,000 and now total, for 1956, $15,000,000. State funds have always carried the largest share of the expense of the crippled children's programs.

State programs have taken advantage of many new developments which both public and private research has produced. Among the technological gains made during the two decades, mentioned by Dr. Davens, are these:

- Improved case finding and treatment facilities, as well as pasteurization of milk and the new antibiotics have dramatically reduced bone tuberculosis.
- Chemotherapy and antibiotics have greatly reduced the number and severity of osteomyelitis.
- The new Salk vaccine promises to control paralytic poliomyelitis.
- Sulfadiazine and penicillin have made possible the control of rheumatic heart disease.
- New operative technics have opened the way to successful treatment of over half the cases of congenital heart disease.
- Creation of the new medical specialty, clinical audiology, has revolutionized treatment of extremely deaf children.
- Child amputees can now be provided with extremely deft upper and lower limb prostheses.
- Greatly improved drugs are available which can control seizures in 80 per cent of children with epilepsy.

In the future, Dr. Davens believes, the men and women who direct the state programs for crip-

pled children hope to concentrate on ways to move in on conditions which lead to crippling, and treat them before they become handicapping. This approach is particularly applicable with children with rheumatic fever and hearing difficulties. To be successful, the children must be found early, and the cooperation already established between these public programs and other public and voluntary health services must be continued and expanded.

Red Cross Issues Handicapped Swimming Manual

To provide authoritative information and guidance to individuals and organizations concerned with teaching handicapped persons to swim, the American Red Cross has published an instructor's manual on the subject.

The 60-page manual, *Swimming for the Handicapped*, is based on experience gained in a program started in 1945, when the Red Cross cooperated with the armed forces to provide special swimming instruction for handicapped veterans and servicemen. Since that time much work has been done to provide such instruction to many children and adults through cooperation of Red Cross chapters and organizations working directly with the handicapped. Assistance in preparation of the manual was given by physicians, physical therapists, physical education experts, and water safety instructors.

The purpose of the program, according to the manual, is to teach people to swim or to swim better. Specific objectives of the program are to assist in building or maintaining organic strength and vigor, provide recreational outlets, and improve morale of the participants. That these objectives can be reached has been clearly shown by the enthusiastic response from parents, doctors, and handicapped persons in those communities where programs have been carried on.

Included in the manual is a section of background information that outlines the general physiological and psychological values of swimming, lists the facilities and equipment needed, and provides explanatory information that will help instructors better understand and teach the handicapped.

Part II describes in some detail the specific program for various conditions. Pointing out that the swimming program for each person must be planned on the basis of the doctor's recommendation, the section covers six types of conditions: temporary orthopedic disabilities, permanent disabilities due to loss of body parts, paralysis due to injury or disease, permanent disabilities due to heart condition, permanent disabilities due to sight and hearing difficulties, and disabilities due to mental illness. In each category information given includes a description of the conditions in terms of the physiological and psychological aspects, the specific values of swimming, the specific objectives of the program, the skills to be taught the individual to produce desired results, and teaching suggestions to make the instructor's work more effective.

An appendix contains information on operation of the program, a pictorial display of joint motions, and a glossary.

The manual is designed primarily for use by swimming instructors who have participated in a special training course offered through the Red Cross. However, it is expected that the manual may also be useful to professional workers in organizations dealing directly with handicapped individuals.

Further information concerning the program and the manual can be obtained from local Red Cross chapters or from area offices located in Alexandria, Va., Atlanta, Ga., St. Louis, Mo., and San Francisco, Calif.

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Physical Therapy Programs—1956

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Abstracts

Medical and Social Aspects of the Treatment of Rheumatoid Arthritis.

J. J. R. Duthie, M. Thompson, M. M. Weir and W. B. Fletcher, ANN. RHEUMAT. DIS., 14: 133-149, June 1955

The objects of this study were to assess the immediate results of treatment in the hospital on patients with rheumatoid arthritis; to ascertain how long improvement could be maintained after discharge; to determine the relationship between clinical progress and changes in social and economic status; and to obtain information about factors which might help to predict the likely response to treatment of individual patients. The group studied consisted of 307 patients; 282 of this group were available for assessment at the last follow-up examinations. The conclusions which have been drawn are as follows:

1) The admission to the hospital of patients with rheumatoid arthritis is followed in the majority of cases by a substantial improvement in functional capacity and a significant decrease in the activity of the disease.

2) Improvement is well maintained after discharge, although a more prolonged follow up would be required before it could be claimed that the natural course of the disease was significantly altered.

3) A close relationship exists between improvement in the medical sense and betterment of social and economic circumstances.

4) When skilled help and advice are available, increase in functional capacity leads to increased efficiency at home and at work.

5) In predicting the immediate response to treatment and the subsequent course of the disease, the most important single factor appears to be the duration of symptoms before admission to the hospital. Patients admitted within one year of onset respond very well to the basic regime of treatment and the majority continue to improve after discharge. Results at this stage of the disease may be favorably influenced, however, by the admission of a proportion of patients in whom the disease was destined to run a relatively benign course.

6) An acute onset followed by a rapidly progressive course in the early stages may indicate a rather benign form of the disease.

7) The erythrocyte sedimentation rate and the level of disease activity on admission have little bearing on the prognosis.

8) A mild or moderate degree of anemia on admission is not of grave significance, but when anemia is more severe, response to treatment is less satisfactory.

9) Detailed medical and social supervision may play a fundamental part in consolidating the benefits of hospital treatment. The medical social worker occupies a key position in the organization of long term care and follow up.

10) The results which follow the conscientious application of conservative forms of treatment in the hospital compare favorably with those claimed for other forms of treatment, such as the administration of gold or cortisone.

Pediatric Evaluation of Brain Damaged Children.

H. E. Thelander, P. PEDIAT., 46: 699-703, June 1955

This paper is an analysis of some clinical aspects and suggestions for therapy of cerebral palsied children. The survey was made of 131 children, ranging in age from birth to 10 years, admitted to the Children's Hospital in San Francisco since 1952.

In addition to the primary diagnosis, it was found that the child usually had other major handicaps. The average child had 2.3 disabling handicaps. The growth and development of 99 patients were studied and compared with normal children of equal ages. Of the cerebral palsied children, 75 per cent fell below the three percentile line in height and 70 per cent fell below this level in weight. In another analysis of 22 children, 10 showed marked retardation in bone growth. These 10 children were not always the most severely handicapped. While the children's teeth erupted in the normal time and manner, the teeth of the severe spastic and athetoid children were ground almost down to their gums.

It is suggested that an evaluation of intelligence be approached cautiously and postponed until the child is five years old. In the meantime the child's emotional status should be guarded closely and he should be in an environment that will stimulate activity and socialization. A special nursery school is most advisable.

Concerning early classification as to prognosis, four categories are suggested, namely: (1) possible restoration of function; (2) limited function but self-sufficient status eventually; (3) partly dependent always; and (4) probably totally dependent always.

The cost of adequate care of the brain damaged child is great and frequently cannot be met by private means. Diagnostic studies and therapy should by done by qualified teams and every effort should be made to rehabilitate the child and to support the parents in their attempt to do this.

Infantile Spastic Hemiplegia. III. Intelligence.

Meyer A. Perlstein and Phillip N. Hood, PEDIATRICS, 15: 676-682, June 1955

The results reported in this paper are based on studies of 334 patients seen during the past 10 years. The intellectual assessment in all cases was made by qualified psychologists. From this study the following conclusions were made regarding the intelligence of infantile spastic hemiplegics to various factors.

The spastic hemiplegics of the series were retarded approximately 20 I. Q. points below normal individuals. The mean I. Q. scores and the incidence of mental retardation were in close agreement with earlier reports.

Left and right hemiplegics did not differ significantly either in mean I. Q. scores or in the incidence of mental deficiency. Male and female hemiplegics did not differ significantly. The mean I. Q. scores of the congenital and acquired cases did not differ significantly nor was there a greater incidence of mental deficiency in either of the two groups.

Mental deficiency was significantly related to the presence of convulsions; the mean I. Q. score of the convulsives was significantly lower than that for the nonconvulsives by 12 I. Q. points.

There was a significantly greater number of mental defectives below the age of 6 years than above that age, although the mean I. Q. scores did not differ significantly between the two groups.

The infectious and traumatic groups of acquired etiologies showed no significant difference in mean I. Q. scores. The toxemia of pregnancy group showed approximately the same incidence of mental deficiency and the same mean I. Q. score as the group composed of all other congenital etiologies of spastic hemiplegia.

The Surgical Management of Funnel Chest.

P. F. Hausmann, J. THORACIC SURG., 29: 636-648, June 1955

Physical therapy is of great importance in the avoidance of a recurrence of the funnel chest deformity after surgery. A child with this deformity will have a round shouldered, potbellied profile with a sternal depression.

The author describes the surgical procedures. The simple cutting of a hypertrophied substernal ligament will in many cases correct the deformity, but usually the deformity has a skeletal origin which necessitates extensive subperichondrial resection of costal cartilages. Paradoxical breathing usually accompanies the deformity. There is contraction of the lower thorax and both costal arches as well as retraction of the sternum on inspiration. It is found that the greater the degree of paradoxical motion in breathing, the more likely the defect will persist or enlarge. This usually disappears following surgery but makes breathing exercises equally as important as posture exercises. Physical therapy is begun on the third or fourth day following surgery and is continued until such time that the child overcomes his tendency to slouch with consequent dorsal kyphosis and protuberant abdomen.

Set Realistic Charges for Physical Therapy.

Arthur A. Rodriquez and Alfred Rodriquez, HOSPITALS, 29: 88-92, June 1955

Many physical therapists are faced with the problem of determining charges for physical therapy treatment. This paper was written by a clinical associate professor of physical medicine and rehabilitation and a certified public accountant.

The purposes of the physical therapy fee are to compensate the hospital for the cost of providing the service, to permit the hospital to continue giving therapy, and to keep up with modern advances and changes in the field. Some principles of cost estimation in the physical therapy department are discussed in this paper. The cost of treatment depends upon three factors—direct labor required, the overhead for time the patient occupies a booth or space in the department, and the cost of equipment used. Suggestions are given for computing an average productive hourly rate for the cost of direct labor; an average hourly overhead rate and an hourly equipment cost. An allocation of the overhead on the basis of a patient's occupancy of space and time is imperative, as a significant portion of the patient's time in the department requires no direct labor.

Existing schedules of charges at several representative institutions are reviewed and discussed. It is emphasized that the charges for physical therapy treatment should be based upon their true value.

Cerebral Pedunculotomy for Involuntary Movements.

A. E. Walker, SURG., GYNEC. & OBST., 100: 716-720, June 1955

Interruption of the corticospinal pathway will abolish the abnormal movements of athetosis, choreoathetosis, hemiballismus, and Parkinson's disease. The section of this pathway has usually been at the cortical level which has two disadvantages—the occurrence of aphasia and the possibility of a late developing epilepsy. The author reports on the technic and results of partial section of the cerebral peduncle for involuntary movements. At this site the corticospinal tracts are relatively isolated, superficial, and accessible to surgical approach. Also, many extrapyramidal fibers may be spared to provide more volitional movement than when both pyramidal and extrapyramidal tracts are cut.

The operation is described in detail. Usually a weak current from a 60 cycle sine wave stimulator is used to elicit responses from the peduncle in order to determine the extent of the section. If only the arm is involved in the involuntary movements the cut may be made across that portion of the peduncle from which arm responses were elicited by stimulation, the corticospinal fibers to the leg being spared. The desired result is a section to the point at which induced movements of the affected limbs are almost but not quite abolished. Most patients with a severe tremor consider the shaking member as worse than useless, and generally judge their weakened limb to be more dexterous and valuable to them.

For optimal results the patients must be carefully selected. So far only patients with unilateral involvement have had this surgery. In the second place, involuntary movement must be the most prominent disability. The physiologic age of the patient should not be more than 50 years and the patient should be enthusiastic about having the operation.

Common Speech Defects in Children.

Roderick B. Ormandy, NORTH CAROLINA M. J., 16: 145-147, April 1955

Speech development is an orderly but complicated procedure. A knowledge of the process is of value not only in determining the severity of the speech defect, but also in planning a program of therapy for the child.

Vocalization begins with the first cry after birth. For the first month the crying and noises do not communicate desires too well, but in the next few months sounds become differentiated and the mother is able to tell the expression of the child from the quality of the sound. During the first six months the child develops a physiologic readiness for speech. One of the changes occurring during this period is the change in the breathing pattern; there is a reduction in the rate and breathing becomes more rhythmical and uniform. Other activities of the first six months such as sucking and feeding help to develop consonant sounds. During the second six months of life, sociologic readiness for speech is developed. The child should be rewarded for attempts at sound and expression. At one year the child begins speech, which is primarily his own private jargon and language. At 18 months he has increased his vocabulary to 20 words and at two years to 200 words. At three years he is using simple sentences. He begins to master pronunciation from three to seven years and the normal child articulates correctly after eight years.

During these formative years of speech emotional stresses can interfere with speech development. Not considering the physical causes of delayed speech such as cleft palate, cerebral palsy, etc., about 85 per cent of the speech defective population have "functional articulation problems," that is, they have not mastered the formation of speech sounds at the usual time. These children need evaluation and help from a skilled group of workers including the physician, dentist, psychologist, and speech therapist. The benefits accruing both to the child and the parents from a program of therapy more than outweighs the time and effort involved.

Economic Advantages of Early Ambulation.

D. J. Leithauser, THE J. MICH. STATE MED. SOC. 54: 697-700, June 1955

The high cost of medical care, particularly hospitalization, has become a matter of vital concern everywhere, to the patient, to hospital management, to the medical profession, to insurance companies, and to the community as a whole. A significant contribution to the solution of this problem could be made by reducing the average period of postoperative hospitalization.

Reduction of hospital stay by at least 50 per cent has been reported by surgeons who have applied early ambulation aggressively and consistently. The general trend toward methods that promote rapid recovery has taken place entirely within the past ten years.

The author has incorporated the following into his postoperative regimen as routine p ctice: Three times out of bed in rapid succession immediately after recovery from the anesthetic. This is a standard order and is supervised by nursing personnel. After this first "triple-rising" procedure, most patients can get out of bed without assistance, and are instructed to walk frequently. The wounds of patients who exercise immediately after operation heal more rapidly.

As more and more experience is gained by the entire surgical profession; as hospital structures and routine functions are modified to conform to present methods and needs; and as more patients learn to assume a positive attitude toward rapid recovery after operation, it seems certain that the majority of surgical patients will require only one or two days treatment in the hospital following all but the most formidable surgical procedures. When this is practiced hospital costs and the cost of prepaid hospitalization insurance can be reduced.

The Physiology of the Aging Process in the Musculoskeletal Apparatus.

Edgar M. Bick, GERIATRICS, 10: 274-277, June 1955

Most musculoskeletal disabilities of the aged are tissue responses to metabolic or endocrine changes of a systemic nature. Although systemic in operation, their effect on the major musculoskeletal tissue is rather specific.

In the physiology of the normal aging musculoskeletal apparatus articular cartilage is found to be the most stable and least contributory to disability and dysfunction.

The fundamental characteristic of the normal aging skeleton is not the lack of mineral salts, but is an imbalance is the deposition-resorption equation of trabecular molecules. In the presence of a normal diet, the existing trabeculae of aging bone are adequately calcified; it is the decrease in the density of trabeculae per volume that forms the characteristic of senile osteoporosis. In the aged, trabecular absorption takes place normally but the synthesis and deposition of bone protein diminishes. Endocrine and metabolic deficiencies and dysfunctions interfere with the synthesis and distribution of the chemical elements needed for the production of bone substance. Some of the manifestations of the aging skeleton are generalized osteoporosis, avascular necrosis at areas of maximum stress, fractures at the brittle neck of the femur, compression of the vertebral body, and, in the presence of faulty joint mechanics, collapse of subchondral bone.

The characteristic of an aging muscular apparatus is atrophy of disuse. Diminished strength lies in the failure of the neural control mechanism, in the lessened rapidity of chemical reactions involved in muscle contraction, and in the decreased ability of the vascular tree to deliver quickly stream elements needed to replace those used up in muscle activity.

The chief physiologic problem of orthopedic geriatrics is the synthesis of bone protein. Articular cartilage is apt to persist unchanged well into the late decades. Muscle tissue remains unchanged except as its power is influenced by circulatory or central nervous system deterioration.

Portable Apparatus for Intermittent Head Traction in the Sitting Position.

Wallace B. Hamby, J.A.M.A., 158: 182, May 21, 1955

There are a variety of methods for applying head traction, depending on the effect desired. This particular apparatus is designed: 1) to be used in the patient's home as often as desired; 2) to have stress supplied by the weight of the patient's body rather than a prescribed number of pounds of weight; 3) for portability, for persons who live in apartments or who travel; and 4) for availability at a reasonable cost. The apparatus consists of the conventional canvas head halter, with rings held in a wide loop of heavy traction cord. The traction cord is passed through a pulley which is attached to metal ice-tong calipers which may be clipped over the edges of a door frame. The end of the cord passes through a line-tightener, locking device.

To use the apparatus, the patient sits in a chair under the caliper, and adjusts the head halter. He pulls on the traction cord and locks it into position while sitting erect. The patient can then relax and by slumping put a comfortable amount of traction on his neck. The patient has control over the amount of traction and can release it by sitting up or by tripping the line tightener.

The patient should use the traction several times a day, for periods of tolerance, as long as symptoms indicate a need for its use. If prescriptions of traction of definite weight are desired, a spring balance can be tied in line with the patient's eye level.

Leucocyte Response to Brief Severe Exercise.

K. Lange Andersen, J. APPL. PHYSIOL., 7: 671-674, May 1955

The leucocyte response to brief, severe exercise was determined in 13 healthy men ranging in age from 20 to 40 years. The experiments were conducted under laboratory conditions with controlled temperature and humidity. The exercise device was a motor driven treadmill inclined at a grade of 8.6 per cent and set to run at 10 m.p.h. Three of the subjects were studied during a 2-hour recovery period.

The results show briefly: 1) the exercise leucocytosis ranged from 27 to 131 per cent of the pre-exercise values. A tendency was observed for the total number of leucocytes and the number of lymphocytes and monocytes to increase concomitantly with increased running time. 2) A peak in the leucocytosis was reached 15 minutes after termination of the run; 30 to 60 minutes after exercise, the pre-exercise level was reached, and in one case it dropped below this level. At the end of the recovery period studied, a slight leucocytosis was observed. 3) The lymphocytosis changed to lymphopenia during the recovery period. The monocytes followed a similar pattern to the lymphocytes. 4) No signifi-

cant changes were observed in the number of neutrophilic granulocytes immediately after exercise. During the recovery period an increased number of neutrophils were observed. The eosinophils followed a similar pattern to the lymphocytes.

Isolated Paralysis of the Serratus Anterior Muscle.

J. T. H. Johnson and Henry O. Kendall, J. BONE & JOINT SURG., 37-A: 567-574, June 1955

Twenty cases of isolated paralysis of the serratus anterior muscle are presented and analyzed in this paper. Of these, 17 had benefit of a complete examination of the muscles of the involved shoulder girdles and arms, and 12 had repeated muscle examinations. The right side was involved in 18 cases and the left side in 2 cases. The ages of the patients ranged from 9 to 50 years, the average being 32.7 years. Sex distribution was equal. The etiology, so far as it could be determined, was recorded as follows: acute trauma, 2; chronic trauma, 5; postpartum complication, 1; postinfectious complication, 3; postinjection complication, 4; and no known cause, 5.

Strength of the serratus anterior at the first visit ranged from 0 to 30 per cent with an average of 10 per cent; at the third month it was from 45 to 60 per cent, with an average of 50 per cent in 8 recorded cases. At the sixth month, strength of the serratus anterior muscle in 10 recorded cases was from 70 to 100 per cent, with an average of 85 per cent. In 7 cases the follow up was incomplete or the lesion was too recent for evaluation.

The associated trapezius strength was as follows: upper trapezius fibers, average 100 per cent, middle and lower trapezius fibers, average 65 per cent. Associated rhomboid and pectoral tightness was noted in 13 cases and was not mentioned in 7.

Treatment was by the scapular cup type of brace in 11 cases, by canvas shoulder brace in 6 and by physical therapy and sling alone in 3.

At 6 months the relation of treatment to the end results was evaluated as follows: In 6 patients treated with the scapular cup type of brace, the average serratus anterior power was 90 per cent; in 2 patients treated with the canvas brace, the average serratus power was 80 per cent; and in two patients treated by physical therapy alone, the average serratus power was 85 per cent.

Effect of Ultraviolet Irradiation Upon the Cutaneous Pain Threshold.

M. Lipkin, O. Bailey and J. D. Hardy, J. APPL. PHYSIOL., 7: 683-687, May 1955

Cutaneous pain threshold measurements, the degree of hyperalgesia, and intensity of erythema were studied during the development of burns caused by ultraviolet irradiation. A quartz mercury arc was used at fixed distance from the skin, so as to permit one square inch of the volar surface of the forearm to be exposed. Three subjects were used.

It was found that the threshold dosage of ultraviolet radiation which caused the pain threshold to lower was 75 mc (millicalories)/cm^2. The threshold dosage for erythema production was also 75 mc/cm^2. The maximum fall of pain threshold as well as the duration of this lowering, and the intensity of hyperalgesia and erythema increased with increased dosage of ultraviolet radiation.

These experimental data are considered to support the hypothesis that, as a result of irradiation, there is inhibition of metabolic processes of tissue 'repair.' Under these circumstances, slight elevation of skin temperature in a burn area is sufficient to cause pain.

Clinical and Laboratory Findings in Two Hundred Head Injuries.

Milton H. Kibbe, NEUROLOGY, 5: 336-353, May 1955

Two hundred patients who had suffered head injuries during World War II were analyzed. They were selected at random between June, 1944 and January, 1946 from patients at Cushing General Hospital and were classified into three primary groups. Group I, 20 patients, suffered open head injuries without penetration of the dura. Group II, 116 patients, had open head injuries with penetration of the dura. Group III, 64 patients, had closed head injuries with cerebral concussion or contusion.

An analysis was made to determine correlations between amount and location of the brain injury with clinical and laboratory findings. The severity of the findings were divided into 4 groups: 0 — no change from normal; 1 — slight change from normal; 2 — moderate change from normal; 3 — severe changes from normal.

The patients in Group I showed the closest correlation of a variety of observations. For example, if the degree of brain damage was severe, these patients often were ranked in the 'severe' range in other categories, such as final disposition, frequency of headaches and dizziness, spinal fluid pathology, slow wave focus on the electroencephalograph, and original unconsciousness lasting 24 hours or longer. The patients in Group II showed a closer correlation of spinal fluid proteins, electroencephalographic findings, duration of unconsciousness and abnormal neurologic findings. Those in Group III showed correlations of mental change, electroencephalographic and neurological findings. There did not seem to be a marked relationship of severity of brain damage with presence of epileptic seizures and aphasia.

Plastic Appliances Moulded Direct to Patient.

J. B. Brennan, LANCET 1: No. 6869, 841-844, April 23, 1955

Dr. Brennan of the Whittington Hospital, London, describes and illustrates several plastic orthopedic appliances in this paper. The significant aspect of these braces and their application is that after heating they may be moulded directly to the patient. There is no necessity for precasting to obtain size and shape. The appliances are made of polythene and polyurethane. The polythene is an inert, radiolucent plastic which is very durable, moulds easily and accurately. It is quite resilient but extra strips may be added for rigidity. The polyurethane acts as a heat insulator during application of the cast and serves as a comfortable padding in the finished cast.

The procedure for making and applying the appliances is simple. First a pattern is cut out of both of the plastics. Then the pieces are heated and applied and moulded to fit the part. A crepe bandage is wrapped around the plastics to hold them in position for 15 minutes. After that time, the plastics cool and are moulded together in the desired shape.

Two types of appliances are illustrated and described in detail: those for support to limit mobility and those for the purpose of keeping pressure from bedsores. Straps are incorporated into the braces after the original moulding.

Reflections on the Pathogenesis of Progressive Muscular Dystrophy.

Ib Persson, NEUROLOGY, 5: 333-335, May 1955

There have been many theories to explain the pathogenesis of progressive muscular dystrophy. The following new theory concerns a comparison of metabolism in normal muscle and in the muscle of a patient with the disease.

The pathogenesis is an inherited or acquired disturbance in the combination between the iron-actomyosin and the adenosine triphosphate. This causes a reduction of adenosine triphosphate in muscle and the consequent creatinuria. Creatinuria present in later stages of progressive muscular dystrophy is also evident in other muscular diseases and in spinal muscle atrophies. In these conditions, however, it is not due to a lack of adenosine triphosphate. A situation clinically similar to progressive muscular dystrophy can be produced in certain animals by a vitamin E deficient diet. Here again it has been stated that the dystrophy is not due to a reduction in adenosine triphosphate.

A Study of the Hyperactive Autonomic Reflex Initiated by Bladder Distension in Patients with Lesions in the Cervical and High Thoracic Cord.

John A. Hutch, J. UROL., 73; 1019-1025, June 1955

Ten cases are presented in which the hyperactive autonomic bladder reflex is demonstrated. A knowledge of the autonomic bladder is of particular value for the urologist who may be called upon to evaluate the urologic status of patients with high lesions in the spinal cord, and to oversee their bladder training.

Mass parasympathetic responses are observed in the bladder as bladder spasm and may be recorded in cystometrograms or by bladder electromyography. Hyperactive reflexes of the sympathetic system are manifest by vasoconstriction and by pilomotor and sudomotor responses of severe degree. These hyperactive responses are initiated by distention of the bladder and disappear rapidly when the bladder is emptied. It occurs in both complete and incomplete lesions of the cord and has been reported in lesions as low as D-7. The severity of the reaction varies from patient to patient and sometimes one or more of the symptoms will be absent. The exact mechanism by which this reflex manifests itself is not determined. The possibilities are discussed.

At the California Rehabilitation Center the use of tidal drainage in such patients has been abandoned and urethral catheters are not removed until the patient can void satisfactorily without headache, hypertension and sweating.

The desirability of surgical intervention to stop this reflex must be considered on the merits of the individual case. The severity of the symptoms must be weighed against the value of the nerve roots destroyed and the danger of the surgical procedure. Dr. Bors has reported that posterior rhizotomy effectively abolished the reflex. Alcohol in the subarachnoid is also effective but may not prove to be as permanent.

An awareness of this autonomic reflex and of methods by which it may be abolished adds to the understanding of the general problem of cord injury patients and the part played by the distal stump of the spinal cord in the production of some of the bizarre manifestations of spinal man.

Book Reviews . . . . .

An Outline of Neurology. *By Ian A. Brown, M.D., Ph.D., Assistant Professor of Neurology, University of Minnesota, Rochester. Paper. Price $2.00. Pp. 72; illus. Wm. C. Brown Company, Dubuque, Iowa, 1954.*

This outline has been written to present the broad view of neurology in a simplified form for nurses, physical therapists, occupational therapists and some nonprofessional people. There is a need for a simple outline as more and more interest is evidenced in the study of disorders of the nervous system.

The first of the seven divisions deals with a brief discussion of general information and neurological principles. The second division takes up the peripheral nerve. This includes the anatomy, the functions, the causative factors of nerve lesions, the symptoms of these lesions, and the treatment.

The divisions on the spinal cord and on the brain are quite complete. The anatomy of each is briefly but clearly presented. Excellent diagrams are used to augment the anatomical descriptions. The symptomatology of disorders is simplified by concise, clear tables. The disturbances of various areas of the brain are discussed separately which also aids the reader in his understanding of the subject. The author emphasizes the fact that the subject of cord and of brain tumors includes only the more general types but he presents the essentials sufficiently.

Disorders of muscle function and psychotic reactions and organic psychoses are mentioned briefly. Under special procedures are included the main diagnostic and therapeutic procedures, with a short explanation of how and why each is done.

The print is good. The diagrams and tables are definite and concise. As a whole, the material is well organized, but there is confusion in a few places because too much material is included under one heading. Errors are few.

Basic Anatomy. *By G. A. G. Mitchell, O.B.E., T.D., M.B., Ch.M., D.Sc., Professor of Anatomy and Director of the Anatomical Laboratories in the University of Manchester, England; and E. L. Patterson, M.O., Ch.B., B.Sc., Senior Lecturer in Anatomy in the University of Manchester, England. Cloth; price $10.00. Pp. 438. Illus. The Williams & Wilkins Co., Baltimore, 1954.*

This textbook is based on the authors' introductory course of lectures in Basic Anatomy for medical and dental students. The objectives of the authors are clearly met throughout. "The material is presented simply and logically so those with no preliminary biological training should be able to follow the story." The style is mature, the type is very readable on gloss paper. The contents have been selected and synthesized with purpose and bear the stamp of approval through use. There is clarity in presentation and restraint in choice of material to keep information simple, useful, and logical so the student may acquire a general knowledge of the entire body in his first term of anatomy.

The book is intended to be used with the instructor and not as a reference so the authors have not provided suggestions for further study. There is no bibliography for

the same reason; however, there is a good glossary. The authors have included all the information they regard as desirable in an introductory course. They have purposely omitted references to all names of men and dates except those of historical importance in the opening chapter, "Brief History of Anatomy," because they feel the material is unnecessary in a book intended primarily for teaching not as a work of reference. The absence of various mens' names in reference to the naming of positions and nature of structures is helpful in keeping the information simple and the emphasis clear.

There is in every chapter "synthesis of facts from various subjects into a story that may serve as a bridge between biology, anatomy, physiology, and clinical subjects." For example, in the chapter on "The Muscles," a relation between anatomy of the coronary circulation and a future clinical picture is shown thus: "The cardiac muscle is abundantly supplied with blood through the coronary arteries, which are the first branches of the aorta, ... The coronary branches do not anastomose freely within the wall of the heart, so if one becomes blocked by a clot the part of the heart supplied is deprived of most of its blood supply, with serious consequences."

This book would be of value on the shelf of a physical therapy library for it would give the reader a general review of systems without requiring him to wade through complete medical detail. Discussion of the muscular system is general with no mention of origin and insertion.

The Normal Child. *By Ronald S. Illingworth, M.D., Professor of Child Health, the University of Sheffield; Pediatrician to the Children's Hospital Unit and the Jessup Hospital for Women, the United Sheffield Hospitals. Cloth; price $6.00. Pp. 342. Little, Brown and Company, Boston, 1953.*

As indicated in its subtitle, "Some Problems of the First Three Years and their Treatment," this book is focused upon the infant and very young child. It includes both the physical and the psychological aspects of development. There are detailed sections on infant feeding, physical care, and common behavioral problems. The general plan of presentation is that of a textbook but it is enlivened by frankly personal comments, convictions, and enthusiasms. The content is detailed, forthright, and so clearly presented that it can be readily understood by parents as well as by doctors and nurses. The points of view of other writers on this subject are discussed, and the developmental standards of Dr. Arnold Gesell are incorporated with sufficient detail to be used as a practical guide. There is a bibliography of 335 titles, additional references, and an index.

The general tone of the book is a reassuring one, especially for young pediatricians and parents who might be inclined to be overly alarmed by conditions or behavior which are more common and more normal than they might think. Dr. Illingworth's natural style seems to be that of a fluent conversationalist who commands interested attention through anecdote and a readiness to express his opinions with sufficient force to stimulate a possible controversy. To suggest that he could write a very entertaining as well as instructive professional autobiography is not to offer criticism of this more practical and labored text.

The Shoulder And Its Environs. *By James E. Bateman, M.D., F.R.C.S.(C) Diplomate of American Board of Orthopedic Surgery; Fellow, American Academy of Orthopedic Surgeons; Orthopedic Consultant, Sunnybrook Hospital, Toronto; Department of Veterans Affairs of Canada; Consultant, Workmen's Compensation Board of Ontario. Cloth; Price $16.25. Pp. 565; illus. C. V. Mosby Co., St. Louis, 1955.*

In a simple and direct manner the author has presented the pathology, clinical course and treatment, both medical and surgical, of lesions affecting the shoulder and neck region. The conditions are divided according to symptoms into three main groups: 1) shoulder and neck pain, 2) shoulder pain, and 3) shoulder pain accompanied by radiating symptoms. The groups are thoroughly discussed in individual chapters, which contain a table on differential diagnosis and a summary of treatment.

Other aspects of the shoulder are considered together in chapters on embryology and congenital deformities, on radiology and anatomy, and on physiology and the mechanism of pain. In addition, there is a discussion on tumors, fractures, and nerve injuries. The final chapter deals with assessment of disabilities from the legal standpoint.

There are a number of well chosen illustrations and a bibliography accompanies each chapter. Although it may have been written for the surgeon, this book may be recommended to the physiatrist and therapist as a good reference text.

An Outline Of Psychiatry. *By Clarence J. Rowe, M.D., Director of the Hamm Memorial Psychiatric Clinic, St. Paul, Minnesota and Clinical Assistant Professor of Psychiatry, University of Minnesota. Paper. Price $1.75. Pp. 62. William C. Brown, Dubuque, Iowa, 1954.*

This is a paper-covered outline form of the general field of psychiatry. Its general pattern is like the familiar synopsis of various courses used in medical schools. It springs out of a course in Introductory Psychiatry taught by the author "to students of nursing, occupational therapy, physical therapy, and some of the other ancillary medical sciences."

The monograph covers the generally accepted formal divisions of psychiatric subjects. It attempts to bring together in a simple way some of the descriptive forms and dynamic formulations without any bickering about which is right or which is wrong. Definitions are precise. The wording is quite clear. The various disease categories are first described and then exemplified. For the intended audience, this booklet can be highly recommended. It could serve as a good jumping off point for the reading of more detailed psychiatric literature by the ancillary medical personnel.

Ultrasonic and Ultrashort Waves in Medicine. *By Johanna M. Van Went, M.D., Director of the Institute for Physical Medicine and Rheumatism, Amsterdam, Netherlands. Introduction by Kenneth Phillips, M.D., F.A.C.P., Director of the Parkway Medical Clinic and Department of Physical Medicine, Jackson Memorial Hospital, Miami, Florida. Cloth; Price $9.00. Pp. 384. Illus. Elsevier Publishing Co., Houston, Texas, and New York, 1954.*

The first portion of this book deals with the use of ultrasonic waves in medicine. Unfortunately, most of the source material is from the European literature published in the years following World War II up until about two years ago. The exaggerated claims for this new modality in the treatment of a host of medical condi-

tions is well known to those who have gone to the trouble of translating these papers. The majority of them are strong on the subjective findings, weak on the objective findings. Up until the past year or so, there have been few well controlled experiments on the biophysical effects of ultrasound.

There is little information in this text concerning the physics of ultrasound, its properties, and effects on biological tissues. The chapters dealing with the treatment of a wide variety of medical and surgical problems will be severely criticized in this country as bordering on quackery.

Likewise the last portion of the book dealing with ultrashort wave (Diathermy) with emphasis on the author's hypophyseal irradiation experiments, will be criticized. The work of Osborne and others in this country upon hypophyseal irradiation disproves any specific therapeutic effect, and its use here is not generally accepted as good medical practice.

It is the reviewer's opinion that it is unfortunate that this book was published at this time. How much better it would have been to wait a few more years until more was known about the biochemical and biophysical effects of ultrasound, and until more scientifically sound reports were available.

The reviews here published have been prepared by competent authorities and do not represent the opinions of the American Physical Therapy Association.

For "Our Book Reviewers for October" see page 569

Classified WANT-ADS

OPPORTUNITY for beginning staff and experienced physical therapist interested in career position with opportunities for advancement in field of physical rehabilitation; opportunity to participate in educational program if desired. Rehabilitation facilities include physiatrist's supervision, speech and occupational therapy, and clinical psychology. Regular benefits and with increased privileges with longevity. Write to Medical Directors, 9145 South Ashland Ave., Chicago 20, Ill.

PHYSICAL THERAPISTS, MALE OR FEMALE, full or part-time, for rapidly expanding rehabilitation center. Adults' and children's program. Liberal salary and holidays; one month's vacation. Write Mr. Breuer, R.P.T., Bird S. Coler Hospital, Dept. of Rehabilitation, Welfare Island, New York.

If interested in PT in the NORTH TEXAS District, contact: Charlene Nelson, Placement Chairman, North Texas District, Texas Chapter of the APTA, 4110 University Blvd., Dallas 5, Texas.

IOWA METHODIST HOSPITAL, Des Moines, Iowa, needs qualified physical therapist. Hospital has 400 beds, including 100-bed Raymond Blank Memorial for Children. Postpolio cases and in- and outpatient work. Competent professional staff and assistants, excellent working relationships. Apply: Bruce D. Root, Personnel, Director.

WANTED: QUALIFIED physical therapist for 50-bed approved children's convalescent hospital. Fully equipped physical therapy department. Variety of cases, both in- and outpatients. Work 5-day week. Salary open. Write Paul C. Benton, M.D., Medical Director and Administrator, Children's Medical Center, Box 4014, Tulsa, Oklahoma.

WANTED: PHYSICAL THERAPIST to operate new spacious department with all new equipment in 100-bed hospital in Michigan's Upper Peninsula. This northwoods, pollen free climate will be heaven to you if you are an asthmatic or hay fever sufferer. Excellent salary and working conditions. Write to Kenneth D. Moburg, Administrator, Francis A. Bell Memorial Hospital, Ishpeming Michigan.

WANTED: PHYSICAL THERAPIST. Home and center therapy, parent instruction. Excellent salary. Transportation furnished. Good personnel practices. Liberal vacation and sick leave policies. Write Jack Sabloff, M.D., Director, Crippled Children's Division, State Board of Health, Dover, Delaware.

WANTED IMMEDIATELY: PHYSICAL THERAPIST for private doctor's office. New ground floor. Air-conditioned. To head department as it grows. Salary is excellent. Apply Dr. G. R. Dawson, Florence, S. C.

POSITION: Physical therapist for new cerebral palsy center. If person has had sufficient experience, directorship will be open also. Apply to Mrs. Thomas Owen, Amarillo Cerebral Palsy Center, Amarillo, Texas.

TWO PHYSICAL THERAPISTS to complete department of 5. Modern equipment and treatment areas; 4,500-bed mental hospital near San Bernardino, Calif. Fine sports area, 40-hour wk., 3 wks. pd. vaca., 11 pd. holidays, 12 days' sick leave, excellent retirement plan. For details write J. H. Turner, Personnel Officer, Patton Hospital, Patton, Calif.

WANTED: A QUALIFIED physical therapist, female, for well equipped department in a modern 275-bed general hospital with outpatient service, paid vacation, sick leave, 6 holidays, salary open. Apply Robert M. Murphy, Administrator, Lima Memorial Hospital, Linden and Mobel Streets, Lima, Ohio.

QUALIFIED PHYSICAL THERAPIST for large cerebral palsy outpatient center with total program. Five-day, 35-hour week. Uniforms and laundry provided. Good salary. Vacations, sick leave, holidays. Write Clinic Director, United Cerebral Palsy Assn., 380 Washington Ave., Roosevelt, N. Y.

PHYSICAL THERAPIST with experience in C. P. as combination Director-Physical Therapist at C. P. Center. Forty-hr. week, air-conditioned building, good salary, incentive increases, all holidays, 3 weeks' vacation, time off for professional meetings. Write A. N. Johnson, 2610 Virginia Street, Baytown, Texas.

Classified WANT-ADS

PHYSICAL THERAPIST WANTED for doctors' office, new department. Located in community of fifty thousand. Good salary. Apply to Drs. Lebold and Anderson, 1107 Livesley Building, Salem, Oregon.

IMMEDIATE PLACEMENT for qualified physical therapist in active department of new 120-bed hospital. Post polio and in- and outpatient work. Excellent salary and personnel policies. Appiy: Administrator, St. Joseph Hospital, Aberdeen, Washington.

PHYSICAL THERAPIST—Attractive salary with regular increases, 40-hour week, to work in a large county hospital. Liberal retirement, paid sick leave, and vacations. Automatic annual salary increases. Must be citizen of U.S. and have completed an approved course in physical therapy. Contact: Wayne County Civil Service Commission, 628 City-County Building, Detroit 26, Michigan.

PHYSICAL THERAPIST: In Hospital-School for rehabilitation of children with orthopedic handicaps. Complete interesting program. Good salary, merit increases. Annual paid vacation, sick leave, excellent retirement plan. Write Vera E. Dennis, Director of Physical Therapy, Illinois Children's Hospital-School, 2551 N. Clark, Chicago 14, Ill.

QUALIFIED SENIOR THERAPIST and staff therapist for outpatient rehabilitation center serving Westchester County. Salaries commensurate with experience. Contact, Eugene Moskowitz, M.D., Director, Mobility, Inc., 10 Heatherbloom Road, White Plains, New York.

WANTED: QUALIFIED PHYSICAL THERAPISTS, male and female at junior, senior and supervisory levels to complete staff at growing rehabilitation center offering total rehabilitation services. Excellent treatment facilities and desirable working conditions. Refer inquiries and applications to the Administrator, Rehabilitation Center, Inc., 340 East Madison Street, Louisville 2, Kentucky.

WANTED: QUALIFIED physical therapist for 370-bed general hospital in town of 50,000 population; 44-hour week, vacation with pay and sick leave, good salary and working conditions in very attractive department, Social Security and insurance. Write to: Mr. James L. Rogers, Administrator, Spartanburg General Hospital, Spartanburg, S. C.

WANTED: QUALIFIED physical therapists for a large department under the direction of a physiatrist; 800-bed general hospital, 40-hour week, 2 weeks' paid vacation, 2 weeks' sick leave, Social Security, laundry. Annual salary increases. Write: Shirley McCluer, M.D., Dept. of Physical Medicine, Baylor University Hospital, Dallas, Texas.

IMMEDIATE PLACEMENT for qualified physical therapist in 500-bed hospital, treating polio, orthopedic, neurological, hemiplegic, and spinal cord lesion cases. Hospital is affiliated with Western Reserve University. Full time physiatrist in charge of department. Five-day week, paid vacation and liberal sick leave. Rehabilitation Department has, at present, a staff of thirty-two. Ideal living quarters, laundry furnished. Please reply to Mrs. Fowles, Highland View Hospital, Harvard Road, Cleveland 22, Ohio.

WANTED: QUALIFIED physical therapist. Opening new department 230-bed, general hospital; 40-hour week. 6 paid holidays, 2 weeks' vacation annually. Social Security, group participation Blue Cross - Blue Shield. Immediate opening — excellent salary. Address: Administrator, Union Hospital, Terre Haute, Indiana.

QUALIFIED PHYSICAL THERAPIST to work in physical medicine rehabilitation department services at progressive Home for the Aged. In- and outpatients 200 census. Salary excellent according to training and experience; 1 month vacation with pay after first year; 12 days' sick leave; 12 Jewish and regular holidays with pay. Uniforms laundered; 1 meal per day. Board Certified Physiatric supervision. Write Administrator, Ben Grossman, Drexel Home, 6140 Drexel, Chicago, Ill.

OPPORTUNITY. New 50-bed Crippled Children's Hospital needs qualified physical therapist. Excellent equipment and facilities in congenial surroundings. Liberal pay and personnel policy, 40-hour week. Write Administrator, Crippled Children's Hospital, 200 Henry Clay Ave., New Orleans, La.

PHYSICAL THERAPISTS for hospital positions with State of Connecticut. Challenging programs, both male and female; therapy on rehabilitation wards; clinical training programs. Starting salary dependent upon qualifications and experience. Excellent working conditions; living accommodations available. Liberal vacation, sick leave, and retirement benefits. Positions under civil service. Write Glendon A. Scoboria, State Personnel Director, State Office Building, Hartford, Connecticut or Dr. Sidney Shindell, Medical Director, Commission on the Chronically Ill, West Street, Rocky Hill, Connecticut.

WANTED: ADDITIONAL physical therapist for 140-bed Children's Hospital. Treatments stress rehabilitation. Salary good, 3 weeks' vacation, 2 weeks' sick leave, 40-hour week. Apply: Jewell Radford, Physical Therapy Department, Mary Free Bed Children's Hospital, Grand Rapids, Michigan.

Classified WANT-ADS

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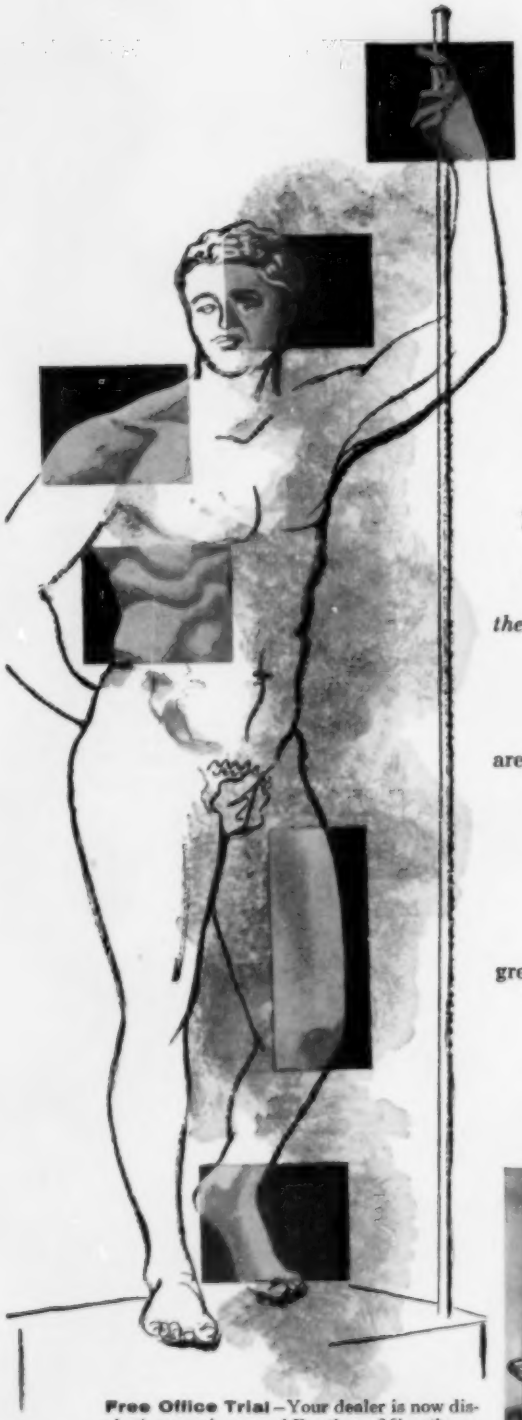

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